PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appeal No. _______________

Application No.:	10/689,001
Filing Date:	October 20, 2003
Appellants:	Applicants, Gayatri Vyas, Hubert A. Gasteiger, Youssef Mikhail, and Llona Busenbender
Conf. No.:	4101
Group Art Unit:	1795
Examiner:	Raymond Alejandro
Title:	ELECTRICAL CONTACT ELEMENT AND BIPOLAR PLATE
Attorney Docket:	8540G-000236/US/COA (GP-300791)

APPEAL BRIEF

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July 13, 2009

Sir:

This brief on appeal is submitted pursuant to the Notice of Appeal filed in the U.S. Patent and Trademark Office on May 13, 2009, and from the decision of the Patent Examiner rejecting claims 1-22 and 55-58 as set forth in the Final Office Action mailed March 9, 2009 ("hereinafter referred to as "FOA").

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I. REAL PARTY IN INTEREST

The present application is assigned to GM Global Technology Operations, Inc. by virtue of an assignment recorded in the U.S. Patent and Trademark Office on January 13, 2009 at Reel 022092, Frame 0703.

II. RELATED APPEALS AND INTERFERENCES

There are no other prior or pending appeals, interferences, or judicial proceedings known to Appellants, Appellants' legal representative, or assignee which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-25, 29-53, and 55-58 are currently pending in the application. Of these claims, claims 23-25 and 29-53 are withdrawn, and claims 1-22 and 55-58 stand rejected. Claims 1-22 and 55-58 are the subject of this appeal.

IV. STATUS OF THE AMENDMENTS

The claims have not been amended subsequent to the FOA. There are no unentered amendments

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Independent claim 1 recites a fuel cell (e.g., see FIG. 1 and Page 2, Line 5) comprising: a solid polymer electrolyte having a permeable body containing a cation exchange membrane (e.g., membrane-electrode-assembly 4, FIG. 1 and Page 19, Line 6); an electrode in electrical communication with said electrolyte (e.g., see Page 19, Line 18); and an electrically conductive contact element (e.g., bipolar plate 8, FIG. 1 and Page 19, Line 7; and bipolar plate 56, FIG. 2 and Page 21, Line 13) having a major working surface (e.g., working face 59, FIG. 3 and Page 21, Line 20) facing said electrode that defines a plurality of reactant gas channels (e.g., channels 20, 22, FIG. 1 and Page 19, Line 11; and grooves 86, FIG. 3 and Page 23, Line 2) separated by a plurality of lands (e.g., lands 84, FIG. 3 and Page 23, Line 2), said electrically conductive contact element having an electrically conductive coating (e.g., coating 94, FIG. 4 and Page 23, Line 16) deposited on and contiguously covering (e.g., see FIG. 4 and Page 23, Line 15) said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition (e.g., see Page 23, Line 17) which has a resistivity of less than .001 ohm-cm (e.g., see Page 9, Line 15), and wherein said electrically conductive coating provides electrical conductivity between said plurality of lands and said electrode (e.g., see Page 9, Line 10), and wherein said coating provides a protective layer (e.g., see Page 10, Lines 1-9) on said contact element from direct contact with a reactant gas in said plurality of reactant gas channels (e.g., see Page 23, Line 3).

Claim 3 recites the fuel cell (e.g., see FIG. 1 and Page 2, Line 5) of claim 1 wherein said electrically conductive contact element (e.g., bipolar plate 8, FIG. 1 and Page 19, Line 7; and bipolar plate 56, FIG. 2 and Page 21, Line 13) comprises a metal substrate (e.g., metal sheets 58, 60, FIG. 4; and Page 21, Line 15) which is susceptible to corrosion (e.g., see Page 24, Lines 5-10), and said coating (e.g., coating 94, FIG. 4 and Page 23, Line 16) is a corrosion-resistant protective coating (e.g., see Page 23, Lines 14-17; and Page 45, Lines 4-13) which protects said metal substrate from a corrosive environment (e.g., see Page 3, Line 1 to Page 4 Line 1) of the fuel cell.

Independent claim 55 recites a fuel cell (e.g., see FIG. 1 and Page 2, Line 5) comprising a solid polymer electrolyte having a permeable body containing a cation exchange membrane (membrane-electrode-assembly 4, Figure 1 and Page 19, Line 6), an electrode in electrical communication with said electrolyte (e.g., see Page 19, Line 18), a gas diffusion member (e.g., carbon/graphite diffusion papers 36, 38, FIG. 1 and Page 19, Lines 15), and an electrically conductive contact element (e.g., bipolar plate 8, FIG. 1 and Page 19, Line 7; and bipolar plate 56, FIG. 2 and Page 21, Line 13) having a major working surface (e.g., working face 59, FIG. 3 and Page 21, Line 20) facing said electrode that defines a plurality of reactant gas channels (e.g., channels 20, 22, FIG. 1 and Page 19, Line 11; and groves 86, FIG. 3 and Page 23, Line 2) separated by a plurality of lands (e.g., lands 84, FIG. 3 and Page 23, Line 2), said electrically conductive contact element having an electrically conductive coating (e.g., coating 94, FIG. 4 and Page 23, Line 16) deposited on and contiguously covering (e.g., see FIG. 4 and Page 23, Line 15) said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition (e.g., see Page 23, Line 17) which has a resistivity less than .001 ohm-cm (e.g., see Page 9, Line 15), and wherein said coating is in direct contact with said gas diffusion member (e.g., see Page 19, Lines 17-19) and provides electrical conductivity between said purality of lands and said electrode (e.g., see Page 9, Line 10), and wherein said coating provides a protective layer (e.g., see Page 10, Lines 1-9) on said contact element from direct contact with a reactant gas in said plurality of reactant gas channels (e.g., see Page 23, Line 3).

Claim 58 recites the fuel cell (e.g., see FIG. 1 and Page 2, Line 5) of claim 55 wherein said electrically conductive contact element (e.g., bipolar plate 8, FIG. 1 and Page 19, Line 7; and bipolar plate 56, FIG. 2 and Page 21, Line 13) comprises a metal substrate (e.g., metal sheets 58, 60, FIG. 4; and Page 21, Line 15) which is susceptible to corrosion (e.g., see Page 24, Lines 5-10) from said reactant gas and said coating (e.g., coating 94, FIG. 4 and Page 23, Line 16) is a corrosion-resistant protective coating (e.g., see Page 23, Lines 14-17; and Page 45, Lines 4-13) which protects said metal substrate from a corrosive environment (e.g., see Page 3, Line 1 to Page 4 Line 1) of the fuel cell.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellants seek the Board's review to determine:

(a) whether the Examiner's rejection of claims 1-3, 13-15, 18-22 and 55-58 under 35 U.S.C. § 103(a) over U.S. Patent No. 5,624,769 ("Li '769") in view of U.S. Patent No. 4,146,657 ("Gordon '657") is proper in view of the prosecution record;

(b) whether the Examiner's rejection of claims 1-2 and 55-57 under 35 U.S.C. § 103(a) over U.S. Patent No. 7,005,205 ("Gyoten '205") in view of Gordon '657 is proper in view of the prosecution record; and

(c) whether the Examiner's rejection of claims 4-12 and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Li '769 in view of Gordon '657, as applied to claim 1 above, and further in view of Appellants' Admitted Prior Art ("AAPA") is proper in view of the prosecution record.

VII. ARGUMENTS IN SUPPORT OF PATENTABILITY

A. Rejection of claims 1-3, 13-15, 18-22, and 55-58 under 35 U.S.C. § 103(a) over Li '769 in view of Gordon '657 is not proper.

1. Independent claims 1 and 55 and dependent claims 3 and 58.

Claims 1 and 55 each recite structure for a fuel cell that includes an electrically conductive contact element having an electrically conductive coating deposited on and contiguously covering lands of a major working surface of the contact element, wherein the electrically conductive coating provides a protective layer on the contact element from direct contact with a reactant gas in reactant gas channels defined by the major working surface. Claims 1 and 55 further recite that the electrically conductive coating includes a doped metal oxide composition that provides electrical conductivity between the lands and an electrode that faces the major working surface.

Claims 3 and 58 depend from claims 1 and 55, respectively, and recite the additional limitations that the electrically conductive contact element comprises a metal substrate which is susceptible to corrosion, and the coating is a corrosion-resistant protective coating which protects the metal substrate from a corrosive environment of the fuel cell. Claim 58 includes the limitation that the electrically conductive contact element is susceptible to corrosion from the reactant gas of the fuel cell.

(a) Li '769 fails to disclose an electrically conductive contact element having an electrically conductive coating that includes a doped metal oxide composition.

The Examiner admits that Li '769 does not disclose the claimed doped metal oxide composition. See FOA at Page 6, Lines 4-5. Appellants and the Examiner agree that Li '769 discloses an electrically conductive topcoat of titanium nitride (Ti-N) 54 applied over a barrier/protective layer 52 formed of a metal, such as stainless steel, onto the core 50 of the contact elements 14 and 16. See, for example, FIG. 2 and Col. 3, Lines 17-32; and FOA at Page 4, Lines 7-10.

However, the Examiner concludes that Li '769 "fully support[s] having a non-ferrous metal-oxide coating in direct contact with the gaseous reactants and the electrode part of the membrane electrode assembly." FOA at Page 5, Lines 6-8. The Examiner's rationale is two-fold. "As evident from Disclosure A above, conventional fuel cells have an oxide film on the surfaces of the contact elements mad from Al or Ti. Thus, the contact elements have thereon a film made of either Al-oxide or Ti-oxide." (Emphasis in original). *Id.* at Lines 1-3. "As further evident from Disclosure B above, the micro-discontinuous Ti-nitride topcoat has a plurality of defects therein exposing the barrier/protective metal layer 52 to the electrodes." (Emphasis in original). *Id.* at Lines 4-5.

Appellants respectfully submit that the teachings in Li '769 do not support the Examiner's rejection on this ground. First, neither disclosure (i.e., Disclosure A and Disclosure B) referred to by the Examiner discloses an electrically conductive metal-oxide composition. Second, neither disclosure teaches a metal-oxide coating deposited on the conductive portions of a contact element (e.g., electrode part). Accordingly, Li '769 fails to teach or suggest a metal-oxide coating in direct contact with the electrode part of the membrane electrode assembly as asserted by the Examiner.

As support for the foregoing assertion, the Examiner points out that Li '769 discloses the formation of oxide films on the surfaces of contact elements made from Al or Ti in Col. 1, Line 65 to Col. 2, Line 3. "Disclosure A", *Id.* at Page 4, Lines 5-6. However, the passage cited by the Examiner teaches that Al and Ti metals corrode in the fuel cell environment to form "highly electronically resistive oxide films on their surface that increases the internal resistance of the fuel cell and reduces its performance." Col. 2, Lines 1-3. (emphasis added) Additionally, that metallic oxides of Al and Ti are highly resistive was commonly known among those of skill in the art of fuel cells. See Declaration under 37 C.F.R. § 1.132 by inventor Gayatri (Vyas) Dadheech (hereinafter "Vyas Decl."), Para. 16, Lines 1-4. Thus, Li '769 suggests the undesirability of metal oxide films on the surfaces of the conductive elements of the fuel cell.

The Examiner also relies on Li '769 as teaching a topcoat of Ti-nitride (Ti-N) 54 deposited on a barrier/protective layer 52 of metal and having micro-discontinuities that expose the layer 52 to the corrosive operating environment of the fuel cell and thereby cause a passivating oxide film to form in the cavities defined by the micro-discontinuities. "Disclosure B", *Id.* at Page 4, Lines 7-12. This passage also contradicts the Examiner's assertion. Li '769 further discloses that the formation of the dense oxide film at the micro-discontinuities does not significantly increase the fuel cell's internal resistance. Col. 3, Lines 23-32. Implicit in this observation is the formation of dense oxide only at the discrete sites of the micro-discontinuities, not more extensively within the conductive Ti-N topcoat, so as to form a coating on the conductive surfaces of the contact element. Vyas Decl., Para. 9, Lines 1-4.

As discussed in detail below in section (d) below, the ordinary meaning of coating is a layer of one substance that is laid or spread over another. As such, the Examiner's assertion that Li fully supports a metal-oxide coating is contrary to the plain meaning of coating. Moreover, topcoat layers, such as the Ti-N layer disclosed by Li, have been the conventional approach used to minimize the formation of resistive metallic oxide layers on the conductive elements of fuel cells. See Decl., Para. 9, Lines 1-4; and 16, Lines 1-6.

In view of the foregoing, Appellants respectfully submit that Li, including Disclosures A and B, refutes, rather than supports, the conclusion reached by the Examiner.

(b) Gordon '657 does not disclose structure for a fuel cell as recited in claims 1 and 55.

In making the rejection of claims 1 and 55, the Examiner does not rely on Gordon '657 for the structural limitations of the fuel cells recited in claims 1 and 55, including the recited electrically conductive contact element.

(c) The Examiner fails to establish a *prima facie* case of obviousness on the basis of Li '769 in view of Gordon '657.

As best understood by Appellants, the Examiner provides one rationale in setting forth the rejection of claims 1 and 55 and four rationales in response to Appellants' arguments. Appellants address each of these rationales in turn and respectfully submit that none of the rationales establish a *prima facie* case of obviousness.

In setting forth the rejection of claims 1 and 55, the Examiner concludes that "it would have been obvious to a person possessing a level of ordinary skill in the field of [the] invention at the time the invention was made to use the specific fluorine doped tin oxide of Gordon '657 in the electrochemical cell of Li '769 et al because Gordon '657 directly teaches that such specific oxide films find application in electrochemical systems or environments due to their high electrical conductivity and suitable expansion coefficient." See FOA at Page 7, Lines 3-7.

Appellants respectfully submit that the combination of Li '769 and Gordon '657 is improper under this rationale for the following reasons: (i) Li '769 teaches away from a conductive contact element having the recited coating deposited on and contiguously covering lands of a major working surface; and (ii) neither Li '769, Gordon' 657, nor the knowledge of one of skill in the art of fuel cells teaches or suggests that the combination of the metal oxide composition of Gordon '657 with the fuel cell of Li '769 would have yielded nothing more than predictable results.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. M.P.E.P. § 2141.02; *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 U.S.P.Q. 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984).

As discussed under heading (a) above, Li '769 discloses applying a non-metallic oxide composition, Ti-N, to the core 50 of the contact element 14 to protect the core 50 and thereby minimize the formation of resistive metallic oxide layers on the core 50 and/or passivating layer 52. As such, Li '769 teaches away from a conductive contact

element having an electrically conductive coating including a metallic oxide composition deposited on the working surface of the contact element as recited in claims 1 and 55.

A rationale to support a conclusion that a claim would have been obvious in view of the combination of references requires that the combination would have yielded nothing more than predictable results to one of ordinary skill in the art. M.P.E.P. § 2143.02; and *KSR International Co. v. Teleflex Inc.* (hereinafter "*KSR*"), 550 U.S. ___, ___, 82 U.S.P.Q.2d 1385, 1395 (2007). Thus, in order to properly combine references to arrive at the claimed device, a reasonable expectation of success must be shown. *Id.*

The Examiner concludes that claims 1 and 55 are obvious on the basis that Gordon '657 teaches that such specific oxide films find application in electrochemical systems or environments due to their high electrical conductivity and suitable expansion coefficient. The Examiner's rationale borders on being conclusory and fails to acknowledge or address the technical challenges introduced by the significant differences that exist between the environments and substrate materials of a fuel cell (claimed subjected matter) and those of a solar cell (Gordon '657), as well as the general knowledge held by those of skill in the art in fuel cells concerning metal oxides. The foregoing challenges and differences introduce significant uncertainty whether predictable results would be expected by those of skill in the art of fuel cells. In view of these problems, Appellants respectfully submit that one of skill in the art of fuel cells would not have held a reasonable expectation of success in applying the process disclosed by Gordon '657 to the structure disclosed by Li.

Gordon's teachings are directed to the use of specific oxide films in solar cells or other optical-electronic devices, but not more broadly to use in the electro-chemical systems of fuel cells or similar environments. Rather, Gordon '657 teaches that "[s]uch layers are useful as transparent electrodes for solar photovoltaic cells, photoconductive cells, liquid crystal electro-optical displays, photoelectrochemical cells, and many other types of optical-electronic devices." Col 1, Lines 11-15. Gordon '657 further discloses that the objects of his invention include providing "improved articles such as solar cells, other semiconductors useful in electrical circuitry, heat-reflective windows, improved

sodium lamps and the like" and permitting "deposition of such layers with standard manufacturing processes in the semiconductor industry and glass industry." Col. 2, Line 63 to Col. 3, Line 2.

None of the applications or objects disclosed by Gordon '657 includes fuel cells or involves the caustic environment of a fuel cell. Electrochemical systems vary greatly and the environment of the solar cells disclosed by Gordon '657 does not include the oxidizing and reducing gases (e.g., oxygen and hydrogen) and acidic compounds (e.g., per fluorocarbon sulfonic acid) present in a fuel cell environment. See Vyas Decl., Para. 7, Lines 1-7. Thus, the advantages disclosed by Gordon '657 (e.g., transparency, high electrical conductivity, and thermal expansion coefficient) do not extend to a broader application in the environment of a fuel cell, particularly considering the fact that un-doped tin oxides, like other metal oxides, are commonly known by those of skill in the art of fuel cells to be unstable in the fuel cell environment. See Vyas Decl., Para. 8, Lines 1-3; 13, Lines 1-4; and 15, Lines 1-3.

Additionally, Gordon '657 neither discloses, nor suggests using the disclosed process to deposit the coating on the metallic substrates disclosed in Li '769 and typically used in fuel cells, such as stainless steel, aluminum, and titanium. See Li '769 at Col 3, Line 17-23; and Vyas Decl., Para. 6, Lines 1-7. Substrates consisting of stainless steel, aluminum, and titanium, unlike the glass substrates disclosed by Gordon '657, tend to oxidize in the presence of heat, such as that used by Gordon's process, causing a highly resistive oxide layer to form on the surface of the substrate. Vyas Decl., Para. 6, Lines 4-7.

Moreover, that Gordon '657 discloses a good match between the thermal expansion coefficient of Gordon's coatings and the silicon-based substrates to which the coatings are applied is not helpful to assessing the applicability of the coatings to the metallic substrates disclosed by Li '769 and typically used in fuel cells. The match disclosed by Gordon '657 is not helpful, because the thermal expansion coefficients of typical silicon-based substrates are significantly different from those typical of the metal substrates used in fuel cells.

In view of the foregoing, Appellants contend that the Examiner has not considered the references, Li '769 and Gordon '657, as a whole, and fails to articulate reasoning that would support the combination of Li '769 and Gordon '657 to arrive at the structure of the electrically conductive contact element recited in claims 1 and 55. "'[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.'" *KSR*, 550 U.S. ___, 82 U.S.P.Q.2d 1385, 1396 (2007).

In responding to Appellants' arguments regarding the nonobviousness of claims 1 and 55, the Examiner asserts that under *KSR*, four additional rationales support a *prima facie* case of obviousness. See FOA at Page 23, Line 20 to Page 24, Line 8. The Examiner has failed to establish a *prima facie* case of obviousness on the basis of Li '769 in view of Gordon '657 for the following reasons: (i) the Examiner has not properly resolved the factual inquiry into the content of the prior art as required by *Graham* and reaffirmed in *KSR*; and (ii) the Examiner has failed to show or clearly articulate one or more required elements for each of the rationales offered in support of the Examiner's rejection of claims 1 and 55.

In order to establish a *prima facie* case of obviousness, Office personnel must first resolve the *Graham* factual inquiries. *Graham v. John Deere Co.*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) (herein "*Graham*"); M.P.E.P. § 2141. See also, M.P.E.P. § 2143 A-G. As discussed above, the Examiner fails to consider Li '769 and Gordon '657 as a whole and in so doing, has improperly concluded that these references may be properly combined to reject claims 1 and 55.

Once the *Graham* factual inquiries are resolved, Office personnel must determine whether the claimed invention would have been obvious to one of ordinary skill in the art. M.P.E.P. § 2141. The Supreme Court in *KSR* identified a number of rationales to support a conclusion of obviousness. *KSR*, 550 U.S. ___, 82 U.S.P.Q.2d 1385, 1395-97 (2007). The Exemplary Rationales A through G are set forth and discussed in M.P.E.P. § 2143. To reject a claim based on one of the rationales, Office personnel

must clearly articulate specific elements that correspond to the asserted rationale. See M.P.E.P. § 2143 A-G. Appellants address each of the rationales asserted by the Examiner under a separate heading below and demonstrate that the Examiner has failed to show, or at least clearly articulate, one or more required elements under each asserted rationale.

Rationale A

The Examiner asserts claims 1 and 55 are obvious on the basis that all of the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and one of skill in the art would have recognized that the results of the combination were predictable. See FOA at Page 22, Line 20 to Page 23, Line 5.

The Examiner notes that "[t]he predictable result is the high conductivity and good matching of thermal expansion coefficient offered by Gordon's film made of the fluorine doped in oxide." *Id.* at Page 23, Lines 3-5. The rationale offered by the Examiner appears to be based on the Examiner's remarks in making the rejection of claims 1 and 55, where the Examiner asserts the following: "Gordon '657 discloses electrically conductive films comprising fluorine (ABSTRACT/COL 1, lines 5-25); fluorine doped stannic oxide (COL 2, lines 38-42). The coating is an electrically conductive coating (COL 1, lines 24-28/COL 2, lines 38-42) finding application in electrochemical systems or environments (COL 1, lines 12-18). The film material also exhibits good match of thermal expansion coefficient (COL 9, lines 33-42)." See FOA at Page 6, Lines 7-11.

The Examiner fails to show that: (1) one of skill in the art of fuel cells would have found that the results of the combination were predictable; and (2) in combination, each element merely performs the same function.

When asserting this rationale in response to Appellants' arguments, the Examiner provided no bases beyond those offered in making the rejection of claims 1 and 55. As shown above in this section, the Examiner has not shown, or at least

articulated a sufficient basis for finding that one of skill in the art of fuel cells would have found that the application of the process disclosed by Gordon '657 to the metallic conductive elements of a fuel cell disclosed by Li '769 and recited in claims 1 and 55 would produce predictable results.

Additionally, claims 1 and 55 recite that the coating provides a protective layer on the contact element from direct contact with a reactant gas. The Examiner does not assert, nor does Gordon '657 disclose coatings that provide a conductive, protective coating which is resistant to exposure to the reactant gases of a fuel cell environment. Importantly, the environment of the solar cells disclosed by Gordon '657 does not include the oxidizing and reducing gases (i.e., reactant gases) and associated acidic compounds present in the fuel cell environment. See Vyas Decl., Para. 7, Lines 1-7. That Gordon's coatings may inherently possess anti-corrosive properties, is immaterial to showing that Gordon's coatings performed the same function in the solar cells disclosed by Gordon '657. This fact is immaterial since the environment of solar cells does not include the reactant gases and associated corrosives present in the fuel cell environment.

Rationale C

In response to Appellants' arguments, the Examiner further asserts that claims 1 and 55 are obvious on the basis that the use of a known technique to improve similar devices (methods or products) in the same way is *prima facie* obvious. See FOA at Page 23, Lines 6-12.

In support of this conclusion, the Examiner offered the following rationale: "[t]he improvement is the high conductivity and good matching of thermal expansion coefficient offered by Gordon's film made of the fluorine doped in oxide." *Id.* at Lines 10-12.

The Examiner fails to show that: (1) the results of applying the doped metal-oxide composition disclosed by Gordon '657 to the electrically conductive contact element of the fuel cell of claims 1 and 55 would have been predictable to one of skill in

the art; and (2) the solar photovoltaic cells were improved in the same way as the fuel cells of claims 1 and 55.

Again, when asserting this rationale in response to Appellants' arguments, the Examiner provided no bases beyond those offered in making the rejection of claims 1 and 55. As shown above in this section, the Examiner has not shown, or at least articulated a sufficient basis for finding that one of skill in the art of fuel cells would have found that the application of the process disclosed by Gordon '657 to the metallic conductive elements of a fuel cell disclosed by Li '769 and recited in claims 1 and 55 would produce predictable results.

Gordon '657 is specifically directed to an improved process for depositing a layer or coating of fluorine-doped stannic oxide on silicon substrates to achieve improved volume resistivities and surface resistances. See Col. 2, Line 38 to Col. 3, Line 2. Gordon '657 neither discloses, nor suggests an improved process for depositing a layer or coating of fluorine-doped stannic oxide on silicon substrates to achieve improved corrosion resistance. As such, the coating and silicon-based substrate structure disclosed by Gordon '657 did not improve solar photovoltaic cells in the same way as the coating recited in claims 1 and 55 improves the claimed fuel cell.

<u>Rationale D</u>

In response to Appellants' arguments, the Examiner further asserts that claims 1 and 55 are obvious on the basis that applying a known technique to a known device (methods or products) ready for improvement to yield predictable results is *prima facie* obvious. See FOA at Page 23, Lines 13-18.

In support of this conclusion, the Examiner offers the following rationale: "The predictable result is the high conductivity and good matching of thermal expansion coefficient offered by Gordon's film made of the fluorine doped tin oxide." *Id.* at Lines 17-18.

The Examiner again fails to show that: (1) one of ordinary skill in the art would have recognized that the process of applying films to silicon-based substrates as

disclosed by Gordon '657 would have yielded predictable results when applied to the metal substrates in a fuel cell disclosed by Li; and (2) Gordon '657 does not disclose a known technique that is applicable to the fuel cell disclosed by Li.

Again, when asserting this rationale in response to Appellants' arguments, the Examiner provided no bases beyond those offered in making the rejection of claims 1 and 55. As shown above in this section, the Examiner has not shown, or at least articulated, a sufficient basis for finding that one of skill in the art of fuel cells would have found that the application of the process disclosed by Gordon '657 to the metallic conductive elements of a fuel cell disclosed by Li '769 and recited in claims 1 and 55 would produce predictable results.

The Examiner has also not shown or articulated that Gordon '657 discloses a known technique applicable to the fuel cell. At most, Gordon '657 discloses a manufacturing process for applying a specific fluorine-doped stannic oxide film to silicon-based substrates, not a technique known to be applicable to fuel cells or to metal substrates that may be used in fuel cells. As discussed in (a) above, Li '769 discloses the conventional technique in the fuel cell art of applying non-metal oxide compositions to the metal substrates and/or passivating layers on the substrates to minimize the formation of resistive metallic oxide layers on the conductive elements.

<u>Rationale G</u>

In response to Appellants' arguments, the Examiner further asserts that claims 1 and 55 are obvious on the basis that there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention that renders the claimed invention *prima facie* obvious.

In support of this conclusion, the Examiner offers the following rationale: "[a]s disclosed in the Gordon '657 reference, the fluorine-doped in oxide film (coating) exhibits good electrical conductivity and good match of thermal expansion coefficient.

Thus, the motivation for the combination would be to increase conductivity and better match thermal expansion coefficient." See FOA at Page 24, Lines 5-8.

The Examiner fails to show that: (1) there is an insufficient basis for concluding there was a reasonable expectation of success; and (2) the references themselves, even when combined with the knowledge generally available to one of ordinary skill in the art, do not provide the requisite teaching, suggestion, or motivation to modify the reference or to combine reference teachings.

Again, when asserting this rationale in response to Appellants' arguments, the Examiner provided no bases beyond those offered in making the rejection of claims 1 and 55. As shown above in this section, the Examiner has not shown, or at least articulated a sufficient basis for finding that one of skill in the art of fuel cells would have found that the application of the process disclosed by Gordon '657 to the metallic conductive elements of a fuel cell disclosed by Li '769 and recited in claims 1 and 55 would produce predictable results.

The Examiner asserts increased conductivity and match of thermal expansion coefficient as the motivation to combine the references, however Gordon '657 merely discloses that films applied by his process exhibit these properties when applied to silicon-based substrates. Gordon '657 does not disclose, and the Examiner does not provide, any further rationale as to why this disclosure by Gordon '657 would provide the requisite motivation.

In contrast, Appellants have submitted evidence that Gordon '657 does not suggest to one skilled in the art of fuel cells that a doped metal oxide layer may be applied by his process to a metallic substrate. See Vyas Decl., Para. 6, Lines 1-7. As discussed above, the metallic substrates disclosed in Li '769 and typically used in the conductive elements of fuel cells tend to oxidize in the presence of heat, such as the heat used in Gordon's process, causing a highly resistive oxide layer to form on the surface of the substrate. Additionally, as shown above, Li '769 teaches away from the use of metal oxide coatings on the working surfaces of the conductive elements of a fuel cell. Moreover, Gordon '657 does not disclose other material properties of Gordon's

coatings that may provide the motivation to apply the teachings of Gordon '657 to the structure of the fuel cell disclosed by Li. In view of the significant differences between the environment of the solar cells disclosed by Gordon '657 and the environment of the fuel cells disclosed by Li '769 and recited in claims 1 and 55, the omission of such properties by Gordon '657 is significant.

In view of at least the foregoing, Appellants respectfully submit that the Examiner has not shown or clearly articulated all of the elements required to support a *prima facie* case of obviousness under any of the asserted rationales. As such, the Examiner has failed to establish a prima facie case of obviousness. The key to supporting any rejection under 35 U.S.C. § 103 is the clear articulation of the reasons why the claimed invention would have been obvious. M.P.E.P. § 2142. On this basis, Appellants submit that claims 1 and 55 are allowable under 35 U.S.C. § 103(a) over Li '769 in view of Gordon '657. Accordingly, Appellants submit that this rejection of claims 1 and 55 by the Examiner must be overturned.

(d) The Examiner has not properly considered Appellants' evidence which effectively rebuts the asserted claim of *prima facie* obviousness.

During prosecution Appellants submitted a Declaration under 37 C.F.R. 1.132 by inventor Gayatri (Vyas) Dadheech rebutting the Examiner's rejection of the claims under 35 U.S.C. § 103.

The Examiner's decision to maintain the rejection must be based on the totality of the evidence. Facts established by rebuttal evidence must be evaluated along with the facts on which the conclusion of obviousness was reached, not against the conclusion itself. *In re Eli Lilly & Co.*, 902 F.2d 943, 14 U.S.P.Q.2d 1741 (Fed. Cir. 1990).

After being presented with the rebuttal evidence and corresponding argument, the Examiner failed to reconsider the bases of the rejection to confirm their continued viability. M.P.E.P. § 2141(V). The scant and conclusory treatment bases by the Examiner discussed above evidence of this fact. Rather than evaluating the rebuttal evidence in light of the Examiner's evidence, the Examiner questioned the meaning of

certain claim terms, and therefore, the scope of the claims but had no reply to Appellants' evidence.

The Examiner suggests that the language of claims 1 and 55 is not very clear and questions Appellants' characterization of the meaning of the terms "contiguous" and "cover" in the context of these claims. See FOA at Page 13, Line 19 to Page14, Line 19, and Page 16, Lines 8-17. Appellants respectfully submit that the language of claims 1 and 55 is made clear by considering the plain and ordinary meaning of the terms used in the context of these claims.

Claims 1 and 55 recite an electrically conductive contact element having "an electrically conductive coating deposited on and contiguously covering said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition..." During examination, words of a claim must be given their plain meaning unless the plain meaning is inconsistent with the specification. M.P.E.P. § 2111.01; and *In re Zletz*, 893 F.2d 319, 321, 13 U.S.P.Q.2d 1320, 1322 (Fed. Cir. 1989). Merriam-Webster defines "contiguous" as "touching or connected throughout in an unbroken sequence." Merriam-Webster's Collegiate Dictionary 270 (11th ed. 2005). Merriam-Webster defines "cover" as "to lay or spread something over." *Id.* at 288. Applying the plain and ordinary meaning of these terms in the context of the claims, Appellants submit that claims 1 and 55 recite a coating that is spread over the lands in an unbroken sequence (i.e., contiguously covers). As such, the coating recited in claims 1 and 55 is distinguishable from the separate, discrete, and sporadic deposits formed on the working surfaces of the contact elements disclosed by Li '769 (discussed above) and Gyoten '205 (discussed below).

The foregoing interpretation is further supported by the plain meaning of the term "coating" to which the interpretation is applied. For example, Merriam-Webster defines "coat" as "a layer of one substance covering another." *Id.* at 237. Thus, combining the plain and ordinary meanings of the words coat and cover, a coating is a layer of one substance that is laid or spread over another. In view of the plain meaning of the

foregoing terms as used in the claims, Appellants submit that this claim language, when considered in the proper context, is clear and unambiguous.

The foregoing meaning imparted by the term contiguously is fully consistent with the specification and the accompanying drawings. Appellants' specification discloses that the recited coating is formed as a thin uniform layer on the underlying sheet metal part used to form the contact element. See, for example, Para. [0044]. Cross-sectional views of the coatings formed on the sheet metal parts are illustrated in Figures 3-7 and depict the conductive coatings as thin layers that are spread over the lands in an unbroken sequence.

The Examiner contends that this interpretation overlooks the fact that Appellants' lands are separated or spaced apart from each other by an open space or a physical distance. The Examiner's point does not contradict Appellants' interpretation for two reasons. First, as illustrated in Figures 3-7, each of the coating (e.g., coating 94, FIG. 3) is shown to be spread over each of the lands (e.g., lands 84, FIG. 3) individually in an unbroken sequence. Additionally, as shown in Figure 2 and disclosed in Paragraph [0070] of Appellants' specification, the lands interconnect to form the flow field 57 on the working face 59 of the contact element. In view of the foregoing, Appellants submit that the language of claims 1 and 55 is clear and unambiguous, and fully consistent with Appellants' specification.

Appellants' objective evidence of non-obviousness based on unexpected results is commensurate in scope with the claims. M.P.E.P. § 716.02; *In re Clemens*, 622 F.2d 1029, 1036, 206 U.S.P.Q. 289, 296 (CCPA 1980). Appellants explain that the unexpected results include providing a stable (i.e., anti-corrosive) coating of tin oxide on a conductive substrate used in a fuel cell that exhibits low contact resistance between the tin oxide layer, the adjoining substrate, and other adjoining surfaces of the fuel cell. Appellants further explain that the conductive substrates used in fuel cells, as disclosed in Li (and Gyoten as discussed below), are conventionally metallic substrates. With the foregoing in mind, Appellants respectfully submit that claims 1 and 55 are limited to

claiming a fuel cell and do recite the key elements and features of the fuel cell that impart the unexpected results.

Claims 1 and 55 are limited to claiming a fuel cell. The preamble to the claims contains the language "fuel cell" and the body of the claims recites the primary structure that is expected of a fuel cell, such as a "solid polymer electrolyte having a permeable body containing a cation exchange membrane," and "electrode", "an electrically conductive contact element having a major working surface", and a "reactant gas". Further, dependent claims in the application include additional structure indicative of the claimed fuel cell, including the recitation of a "catalytic electrode" (e.g., claim 2), "a corrosive environment" of the fuel cell (e.g., claims 3, 58), a "fluid distribution element...comprising a flow field" (e.g., claim 13), "a series of channels" of a flow field (e.g., claim 18), a "flow field" comprising "lands defining a plurality of grooves for distributing fuel or oxidant" along the working surface (e.g., claims 19, 21).

Additionally, claims 1 and 55 recite a coating that includes a doped metal oxide composition that provides a contiguous, protective layer on the contact element and provides electrical conductivity between the working surface of the contact element and an adjoining electrode. As explained herein, such a use of a doped metal oxide compositions in a fuel cell was not predictable given the teachings of Li '769 (discussed above) and Gyoten '205 (discussed below), the caustic environment of a fuel cell, the general knowledge of skilled artisans concerning metal oxide compositions, and the conventional wisdom and approach in the field.

Appellants further submit that the remaining dependent claims further limit and define the key elements and features recited in claims 1 and 55. In particular, claims 3 and 58 specify that the contact element comprises a metal substrate. Claim 22 specifies a particular doping level that may be used to achieve the resistivity recited in claims 1 and 55.

In sum, claims 1 and 55, either alone and/or in combination with the claims dependent therefrom, such as but not limited to claims 3 and 58, recite the key elements and features found to impart the unexpected results.

In view of the foregoing, Appellants submit that the Examiner has failed to properly consider Appellants' rebuttal evidence and has also failed to assert sufficient grounds for rejecting Appellants' rebuttal evidence. On this basis, Appellants submit that claims 1 and 55 are allowable under 35 U.S.C. § 103(a) over Li '769 in view of Gordon '657. Accordingly, Appellants submit that the rejection of claims 1 and 55 by the Examiner must be overturned.

(e) The evidence as a whole establishes by the preponderance of evidence that Appellants' claimed fuel cell is patentable over the combination of Li '769 and Gordon '657.

The ultimate determination of patentability under 35 U.S.C. § 103 is based on the entire record, by a preponderance of the evidence, with due consideration to the persuasiveness of any arguments and secondary evidence. M.P.E.P. § 2142; *In re Oetiker*, 977 F.2d 1443, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). The legal standard of "a preponderance of the evidence" requires the evidence to be more convincing than the evidence which is offered in opposition to it. *Id.* With regard to rejections under 35 U.S.C. § 103, the Examiner must provide evidence which as a whole shows that the legal determination sought to be proved (i.e., the reference teachings establish a *prima facie* case of obviousness) is more probable than not. *Id.*

On the ultimate issue of the patentability of claims 1 and 55 under 35 U.S.C. § 103, Appellants' rebuttal evidence of record are more convincing than the evidence that has been offered by the Examiner on the following key issues: (i) the scope and content of the prior art; (ii) the lack of a reasonable expectation of success/predictable results when considering the cited references and knowledge of skilled artisans; and (iii) the other key elements of the rationales offered by the Examiner in support of a conclusion of obviousness.

As explained above, the Examiner's conclusory statements do not sufficiently articulate a rationale that would establish a *prima facie* case of obviousness. Assuming arguendo that the Examiner has, Appellants further contend that the evidence and argument offered by the Appellants is more convincing than that which has been

articulated by the Examiner. Appellants respectfully invite the Board to weigh the evidence.

For at least the reasons provided in sections (a) through (e) above, Appellants respectfully submit that claims 1 and 55 are allowable under 35 U.S.C. § 103 over Li '769 in view of Gordon '657. Accordingly, Appellants respectfully submit that this rejection of claims 1 and 55 by the Examiner must be overturned.

2. Remaining dependent claims 2, 13-15, 18-22 and 56-57.

Claims 2, 13-15, and 18-22 ultimately depend from claim 1 and claims 56-57 ultimately depend from claim 55. Therefore, claims 2, 13-15, 18-22, and 56-57 are allowable under 35 U.S.C. § 103(a) over Li '769 in view of Gordon '657 for at least similar reasons as claims 1 and 55 above. Accordingly, Appellants respectfully request that this rejection of claims 2, 13-15, 18-22, and 56-57 be overturned.

B. Rejection of claims 1-2 and 55-57 under 35 U.S.C. § 103(a) over Gyoten '205 in view of Gordon '657 is not proper.

1. Independent claims 1 and 55.

Claims 1 and 55 each recite structure for a fuel cell that includes an electrically conductive contact element having an electrically conductive coating deposited on and contiguously covering lands of a major working surface of the contact element, wherein the electrically conductive coating provides a protective layer on the contact element from direct contact with a reactant gas in reactant gas channels defined by the major working surface. Claims 1 and 55 further recite that the electrically conductive coating includes a doped metal oxide composition that provides electrical conductivity between the lands and an electrode that faces the major working surface.

(a) Gyoten '205 fails to disclose an electrically conductive coating that includes a doped metal oxide composition.

The Examiner notes that Gyoten '205 discloses an electroconductive resin layer that incorporates an electroconductive particulate substance in order to gain

electroconductivity and that powders of metal oxide, such as ruthenium (Ru) oxide, are effective. See FOA, Page 8, Lines 16-19. The Examiner does not rely on Gyoten '205 for the limitation that the electrically conductive coating includes a doped metal oxide composition. See *Id.* at Page 9, Lines 10-12. The Examiner further notes that Gyoten '205 discloses an oxide layer situated between the metal substrate and the electroconductive resin layer. *Id.* at Page 9, Lines 1-5.

(b) Gordon '657 does not disclose structure for a fuel cell as recited in claims 1 and 55.

In making the rejection of claims 1 and 55, the Examiner does not rely on Gordon '657 for the structural limitations of the fuel cells recited in claims 1 and 55, including the recited electrically conductive contact element.

(c) The Examiner has failed to establish a *prima facie* case of obviousness on the basis of Gyoten '205 in view of Gordon 657.

As best understood by Appellants, the Examiner provides one rationale in setting forth the rejection of claims 1 and 55. Additionally, in response to Appellants' arguments, the Examiner provides the same four rationales as discussed above to conclude that claims 1 and 55 are obvious on the basis of Gyoten '205 and Gordon '657. Appellants note that regarding the latter four rationales, the Examiner does not articulate any additional bases based on Gyoten '205. Accordingly, Appellants briefly address each of these rationales in turn below and respectfully submit that none of the rationales has been sufficiently asserted to establish a *prima facie* case of obviousness.

In setting forth the rejection of claims 1 and 55, the Examiner concludes that "it would have been obvious to a person possessing a level of ordinary skill in the field of invention at the time of the invention was made to use the specific fluorine doped tin oxide of Gordon '657 in the electrochemical cell of Gyoten '205 et al because Gordon '657 directly teaches that specific oxide films find application in electrochemical systems or environments due to their high electrical conductivity and suitable thermal expansion coefficient." See FOA at Page 10, Line 19 to Page 11, Line 1.

Appellants respectfully submit that the combination of Gyoten '205 and Gordon '657 is improper under this rationale for the following reasons: (i) Gyoten '205, similar to Li, teaches away from a conductive contact element having the recited coating deposited on and contiguously covering lands of a major working surface; and (ii) neither Gyoten '205, nor Gordon '657, or the knowledge of one of skill in the art of fuel cells teaches or suggests that the combination of the metal oxide composition of Gordon '657 with the fuel cell of Li '769 would have yielded nothing more than predictable results.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. M.P.E.P. § 2141.02; *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 U.S.P.Q. 303 (Fed. Cir. 1983, cert. denied, 469 U.S. 851 (1984).

As discussed under heading (a) above, Gyoten '205 discloses a stainless steel sheet 1 on which is deposited an electroconductive resin layer 2 that incorporates electroconductive particles 3 in order to gain electroconductivity and that powders of metal oxide, such as ruthenium (Ru) oxide, are effective. Col. 4, Lines 15-25; and Col. 6, Lines 12-19. Gyoten '205 further discloses an oxide layer situated between the metal substrate and the electroconductive resin layer that serves as a passivating layer at discrete locations where pinholes 8 exist within the resin layer 2. Col. 8, Lines 17-57; and Col. 6, Lines 27-30. Regarding the oxides that form on the stainless steel sheet, Gordon discloses the chromium oxides that form on a stainless steel sheet are electrically resistive. Col. 1, Line 60 to Col. 2, Line 2; see also Vyas Decl., Para. 11, Lines 1-3. As such Gyoten, similar to Li, teaches minimizing the formation of such oxides on the conductive elements of a fuel cell. See *Id.*

While Gyoten '205 discloses a resin layer containing electroconductive particulate that may include a metal oxide, such as Ru-oxide, Gyoten '205 further discloses that the surface area of the particulate substance should be small to prevent increased contact resistance due to oxidation of the particulate. Col. 4, lines 5-13; and Vyas Decl., Para. 12, Lines 1-7. As such, Gyoten '205 illustrates the conventional

wisdom and approach taken by skilled artisans to minimize the presence (e.g., formation) of metallic oxides on the conductive elements of a fuel cell. See Vyas Decl., Para. 12, Lines 1-3.

In view of the foregoing, Appellants submit that Gyoten '205, similar to Li, teaches away from a conductive contact element having an electrically conductive coating including a metallic oxide composition deposited on the working surface of the contact element as recited in claims 1 and 55.

In responding to Appellants' arguments regarding the nonobviousness of claims 1 and 55, the Examiner asserts under *KSR*, the same four additional rationales discussed in 1(c). See FOA at Page 23, Line 20 to Page 24, Line 8. The Examiner fails to establish a *prima facie* case of obviousness on the basis of Gyoten '205 in view of Gordon '657 for the following reasons: (i) the Examiner has not properly resolved the factual inquiry into the content of the prior art as required by *Graham* and reaffirmed in *KSR*; and (ii) the Examiner has failed to show or clearly articulate one or more required elements for each of the rationales offered in support of the Examiner's rejection of claims 1 and 55.

In order to establish a *prima facie* case of obviousness, Office personnel must first resolve the *Graham* factual inquiries. M.P.E.P. § 2141; see also, M.P.E.P. § 2143 A-G. Appellants contend, as shown above, that the Examiner failed to consider Gyoten '205 and Gordon '657 as a whole and in so doing, has improperly concluded that these references may be properly combined to reject claims 1 and 55.

A rationale to support a conclusion that a claim would have been obvious in view of the combination of references requires that the combination would have yielded nothing more than predictable results to one of ordinary skill in the art. M.P.E.P. § 2143.02; and *KSR*., 550 U.S. ___, ___, 82 U.S.P.Q.2d 1385, 1395 (2007). Thus, in order to properly combine references to arrive at the claimed device, a reasonable expectation of success must be shown. *Id.*

Gyoten '205 discloses a fuel cell structure in which the electroconductive resin layer 2 is deposited on a stainless steel sheet 1. Appellants respectfully submit that one of ordinary skill in the art of fuel cells would not have held a reasonable expectation of success in applying the process disclosed for silicon-based substrates by Gordon '657 to the fuel cell structure disclosed by Gyoten '205. Gyoten '205, like Li '769 discloses using a metallic substrate as the core of the electroconductive separator (i.e., contact element). Thus, Appellants' arguments provided in 1(c) above regarding Li '769 apply similarly here regarding Gyoten '205.

(d) The Examiner has not properly considered Appellants' evidence which effectively rebuts the asserted claim of *prima facie* obviousness.

The Declaration under 37 C.F.R. 1.132 by inventor Gayatri (Vyas) Dadheech, discussed above, sets forth Appellants' bases for rebutting the Examiner's rejection of the claims under 35 U.S.C. § 103 on the basis of Gyoten '205. When presented with the rebuttal evidence and corresponding argument, the Examiner did not, properly reconsider the bases of the rejection to confirm their continued viability. M.P.E.P. § 2141(V). The scant bases and conclusory statements asserted by the Examiner shown above evidence of this fact. Rather than evaluating the rebuttal evidence in light of the Examiner's evidence, the Examiner chose to provide arguments questioning the meaning and therefore the scope of the claims. Appellants have addressed these arguments by the Examiner in 1(d) above and contend Appellants' arguments above apply similarly here regarding Gyoten '205.

In view of the foregoing, Appellants submit that the Examiner has failed to properly consider Appellants' rebuttal evidence and has also failed to assert sufficient grounds for rejecting Appellants' rebuttal evidence. On this basis, Appellants submit that claims 1 and 55 are allowable under 35 U.S.C. § 103(a) over Gyoten '205 in view of Gordon '657. On this basis, Appellants request that this rejection of claims 1 and 55 by the Examiner be overturned.

(e) The evidence of record as a whole establishes by the preponderance of the evidence that Appellants' claimed fuel cell is patentable over the combination of Gyoten '205 and Gordon '657.

Appellants' rebuttal evidence of record are more convincing than the evidence that has been offered by the Examiner on the following key issues: (i) the scope and content of the prior art; (ii) the lack of a reasonable expectation of success/predictable results when considering the cited references and knowledge of skilled artisans; and (iii) the other key elements of the rationales offered by the Examiner in support of a conclusion of obviousness.

As explained above, the Examiner has not sufficiently articulated a rationale that would establish a *prima facie* case of obviousness. Assuming arguendo that the Examiner has, Appellants further contend that the evidence and argument offered by the Appellants is more convincing than that which has been articulated by the Examiner.

For at least the above reasons, Appellants respectfully submit that claims 1 and 55 are allowable under 35 U.S.C. § 103(a) over Gyoten '205 in view of Gordon '657. Accordingly, Appellants request that this rejection of claims 1 and 55 by the Examiner be overturned.

2. Dependent claims 2 and 56-57.

Claim 2 ultimately depends from claim 1 and claims 56-57 ultimately depend from claim 55. Therefore, claims 2 and 56-57 are allowable for at least similar reasons as claims 1 and 55 above.

Accordingly, it is respectfully requested that the rejection of claims 2 and 57 by the Examiner be overturned.

<u>C. Rejection of 4-12 and 16-17 under 35 U.S.C. § 103(a) over Li '769 in view of Gordon '657 and further in view of AAPA is not proper.</u>

1. Dependent claims 4-12 and 16-17.

Claims 4-12 and 16-17 ultimately depend from claim 1. Therefore, claims 4-12 and 16-17 are allowable for at least similar reasons as claim 1 above.

Accordingly, it is respectfully requested that the rejection of claims 4-12 and 16-17 by the Examiner be overturned.

CONCLUSION

Appellants respectfully request the Board to reverse the Examiner's rejection of the claims on appeal.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 07-0960 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

/David A. McClaughry/

Dated: July 13, 2009

By: ______________________
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VIII. CLAIMS APPENDIX

1. (Rejected) A fuel cell comprising:

a solid polymer electrolyte having a permeable body containing a cation exchange membrane;

an electrode in electrical communication with said electrolyte; and

an electrically conductive contact element having a major working surface facing said electrode that defines a plurality of reactant gas channels separated by a plurality of lands, said electrically conductive contact element having an electrically conductive coating deposited on and contiguously covering said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition which has a resistivity of less than .001 ohm-cm, and wherein said electrically conductive coating provides electrical conductivity between said plurality of lands and said electrode, and wherein said coating provides a protective layer on said contact element from direct contact with a reactant gas in said plurality of reactant gas channels.

2. (Rejected) The fuel cell of Claim 1 wherein said electrode is a catalytic electrode on one major face of the membrane, and wherein said coating comprises fluorine doped tin oxide.

3. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a metal substrate which is susceptible to corrosion, and said

coating is a corrosion-resistant protective coating which protects said metal substrate from a corrosive environment of the fuel cell.

4. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a substrate formed of electrically conductive particles dispersed in a binder matrix, and said coating provides electrical contact between said substrate and said electrode.

5. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a matrix of compacted graphite flakes impregnated with a filler.

6. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a conductive substrate, a layer of conductive open cell foam having a first face facing said substrate and a second face facing said electrode, and wherein said coating is deposited on and covers at least one of said first face or said second face of said foam layer.

7. (Rejected) The fuel cell of Claim 6 wherein said open cell foam has external surfaces and internal surfaces defined by openings in said open cell foam, and wherein said coating is deposited on and covers said internal and external surfaces.

8. (Rejected) The fuel cell of Claim 7 wherein said foam has a thickness between said first and second faces, and said coating is present on said internal and external surfaces throughout said thickness.

9. (Rejected) The fuel cell of Claim 8 wherein said coating is deposited on and covers a surface of said substrate facing said foam.

10. (Rejected) The fuel cell of Claim 6 wherein said substrate is a metal sheet and said foam is a metal foam.

11. (Rejected) The fuel cell of Claim 10 wherein said metal sheet is welded or braised to said metal foam.

12. (Rejected) The fuel cell of Claim 1 which further includes an electrically conductive porous material disposed between said electrode and said coated electrically conductive contact element, and wherein said porous material is selected from the group consisting of carbon paper, carbon cloth and metal screen.

13. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element is a fluid distribution element, comprising:

an electrically conductive substrate having first and second major working surfaces, and a flow field at said first major working surface for distributing fluid along

said first major working surface, and wherein said coating is deposited on and covers said first major working surface.

14. (Rejected) The fuel cell of Claim 13 wherein said coating comprises fluorine doped tin oxide.

15. (Rejected) The fuel cell of Claim 13 wherein said substrate is selected from the group consisting of titanium, stainless steel, aluminum, a composite of electrically conductive particles dispersed in a binder matrix; and compacted graphite flakes impregnated with a filler.

16. (Rejected) The fuel cell of Claim 13 wherein said flow field comprises a layer of electrically conductive open cell foam.

17. (Rejected) The fuel cell of Claim 16 wherein said foam is conductive graphite foam or conductive metallic foam.

18. (Rejected) The fuel cell of Claim 13 wherein said plurality of channels is formed in said first major working surface, and wherein said flow field comprises said plurality of channels in said first major working surface.

19. (Rejected) The fuel cell of Claim 13 wherein said flow field comprises said plurality of lands.

20. (Rejected) The fuel cell of Claim 13 which comprises a second flow field at said second major working surface.

21. (Rejected) The fuel cell of Claim 20 wherein said second flow field comprises a series of lands defining a plurality of grooves for distributing coolant fluid along said second major working surface.

22. (Rejected) The fuel cell of Claim 14 wherein the fluorine content of said fluorine doped tin oxide is less than 10 weight percent.

23. (Withdrawn) The cell of claim 1 further comprising an ion conducting electrolyte, said electrode facing the electrolyte, and said electrically conductive contact element in contact with said electrode for conducting electrical current to said electrode.

24. (Withdrawn) The cell of claim 23 wherein said electrically conductive coating comprises fluorine doped tin oxide.

25. (Withdrawn) The cell of Claim 24 wherein said electrically conductive contact element comprises a metal substrate which is susceptible to corrosion, and said coating is a corrosion-resistant protective coating which protects said metal substrate from the corrosive environment of the cell.

26-28. (Cancelled)

29. (Withdrawn) The electrochemical cell of claim 1 wherein said electrically conductive contact element comprises a bipolar plate including a sheet metal product having said coating which is a corrosion-resistant protective coating including a metal oxide composition having a treatment which ensures conductivity.

30. (Withdrawn) The cell of claim 29 wherein the treatment has been carried out in order to produce a crystal structure of the metal oxide composition coating which ensures conductivity.

31. (Withdrawn) The cell of claim 29 wherein the treatment takes the form of a galvanic coating consisting of one of the elements aluminum, chromium, silver, antimony or molybdenum applied directly below the metal oxide composition coating.

32. (Withdrawn) The cell of claim 29 wherein the treatment is executed as a doping.

33. (Withdrawn) The cell of claim 32 wherein the protective coating consists of at least one layer.

34. (Withdrawn) The cell of claim 32 wherein the protective coating comprises an oxide of one of the following elements or alloys of these elements: tin, zinc, indium.

35. (Withdrawn) The cell of claim 32 wherein the protective coating comprises a first layer of a metal oxide, a second layer of a dopant which ensures conductivity, and a third layer of a metal oxide.

36. (Withdrawn) The cell of claim 29 wherein the protective coating comprises an alternating layer sequence of metal oxide composition and dopants which ensure conductivity.

37. (Withdrawn) The cell of claim 29 wherein the protective coating comprises at least two layers.

38. (Withdrawn) The cell of claim 32 wherein the doping which ensures the conductivity comprises at least one element of the group aluminum, chromium, silver, boron, fluorine, antimony, chlorine, bromine, phosphorus, molybdenum and/or carbon.

39. (Withdrawn) The cell of claim 29 wherein the protective coating comprises a protective coating deposited in a vacuum chamber.

40. (Withdrawn) The cell of claim 29 wherein the protective coating has a thickness in the range between 1 monolayer and 1 μ, preferably between approximately 1 nm and approximately 500 nm.

41. (Withdrawn) The cell of claim 29 wherein the sheet metal comprises aluminum, chrome-plate aluminum, copper, stainless steel, chrome-plated stainless steel, titanium, titanium alloys and iron-containing compounds both with and without metallic coating, with the metallic coating including at least one of the elements tin, zinc, nickel, chromium or alloys of these materials.

42. (Withdrawn) The cell of claim 29 wherein the sheet metal product has a thickness in the range from about 0.001 mm to about 5 mm.

43. (Withdrawn) The cell of claim 1 wherein said metal oxide composition comprises metal oxide treated to ensure conductivity.

44. (Withdrawn) The cell of claim 1 wherein the said metal oxide composition comprises a doped metal oxide.

45. (Withdrawn) The cell of claim 1 wherein the metal oxide composition comprises an oxide of an element or alloy of an element selected from the group consisting of tin, zinc, indium, and mixtures thereof.

46. (Withdrawn) The cell of claim 45 wherein said doped metal oxide comprises a dopant which is selected from the group consisting of aluminum, chromium, silver, boron, fluorine, antimony, chlorine, bromine, phosphorus, molybdenum, carbon, and mixtures thereof.

47. (Withdrawn) The cell of claim 1 wherein said electrically conductive contact element conducts electrical current to or from said electrode.

48. (Withdrawn) The cell of claim 2 wherein said electrically conductive contact element conducts current from said electrode.

49. (Withdrawn) The cell of claim 23 wherein said electrically conductive contact element conducts current to said electrode.

50. (Withdrawn) An electrochemical cell comprising an electrode and an electrically conductive contact element facing said electrode for conducting electrical current, wherein said electrically conductive contact element has an electrically conductive and corrosion-resistant protective coating which comprises a doped metal oxide.

51. (Withdrawn) The method of claim 50 wherein said electrically conductive contact element comprises a substrate and said layer overlies said substrate.

52. (Withdrawn) A cell of claim 50 wherein said doped metal oxide is an oxide of an element or alloy of an element selected from the group consisting of tin, zinc, indium, and mixtures thereof.

53. (Withdrawn) The cell of claim 50 wherein said doped metal oxide comprises a dopant selected from the group consisting of aluminum, chromium, silver, boron, fluorine, antimony, chlorine, bromine, phosphorus, molybdenum, carbon and mixtures thereof.

54. (Cancelled)

55. (Rejected) A fuel cell comprising a solid polymer electrolyte having a permeable body containing a cation exchange membrane, an electrode in electrical communication with said electrolyte, a gas diffusion member, and an electrically conductive contact element having a major working surface facing said electrode that defines a plurality of reactant gas channels separated by a plurality of lands, said electrically conductive contact element having an electrically conductive coating deposited on and contiguously covering said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition which has a resistivity less than .001 ohm-cm, and wherein said coating is in direct contact with said gas diffusion member and provides electrical conductivity between said purality of lands and said electrode, and wherein said coating provides a

protective layer on said contact element from direct contact with a reactant gas in said plurality of reactant gas channels.

56. (Rejected) The fuel cell of Claim 55 wherein said coating comprises fluorine doped tin oxide.

57. (Rejected) The fuel cell of Claim 56 wherein the fluorine content of said fluorine doped tin oxide is less than 10 weight percent.

58. (Rejected) The fuel cell of Claim 55 wherein said electrically conductive contact element comprises a metal substrate which is susceptible to corrosion from said reactant gas and said coating is a corrosion-resistant protective coating which protects said metal substrate from a corrosive environment of the fuel cell.

IX. EVIDENCE APPENDIX

A copy of the Declaration under 37 C.F.R. § 1.132, signed by inventor Gayatri (Vyas) Dadheech on February 21, 2008 and submitted with Appellants' Amendment dated February 21, 2008 is attached as "Exhibit A". The Declaration was not objected to in the subsequent Office Action mailed March 19, 2008.

A copy of the pages from Merriam-Webster's Collegiate Dictionary (11^{th} ed. 2003) containing the definitions of the words on pages 237, 270, and 288 cited herein and in Appellants' Amendment dated January 30, 2009 is attached as "Exhibit B". Copies of the attached pages were not provided in Appellants' Amendment dated January 30, 2009. Appellants' Amendment dated January 30, 2009 was entered as evidenced by the Office Action mailed March 9, 2009.

X. RELATED PROCEEDINGS APPENDIX

No copies of decisions rendered by a court or the Board are submitted, as no decisions rendered were identified in section II above.

14496414.2

"EXHIBIT A"

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:	10/689,001
Filing Date:	October 20, 2003
Applicant:	Gayatri Vyas et al.
Group Art Unit:	1745
Examiner:	Raymond Alejandro
Title:	ELECTRICAL CONTACT ELEMENT AND BIPOLAR PLATE
Attorney Docket:	GP-300791 (8540G-000236/COA)

DECLARATION UNDER 37 C.F.R. 1.132

I, Gayatri (Vyas) Dadheech, state as follows :

1. I am a joint inventor with Hubert A. Gasteiger and Youssef Mikhail who made application for a patent on October 20, 2003, which is the subject of the present application.

2. I received a Bachelor of Science degree in Chemistry, Botany, and Zoology from the University of Bhopal in 1987, a Master of Science degree in Chemistry with a minor in Electrochemistry from the University of Bhopal in 1989, and a Master of Science degree in Chemistry with a minor in Material Science from the University of Texas in 1995.

3. I have worked in the automotive industry for fourteen (14) years and with

fuel cells for eleven (11) years.

4. I have worked for General Motors Corporation since 1995, initially as a research engineer and since 1997 as a fuel cell engineer.

5. I have reviewed U.S. Patent No. 5,624,769 to Li et al., U.S. Patent No. 7,005,205 to Gyoten et al., and U.S. Patent No. 4,146,657 to Gordon in detail for their teachings and suggestions regarding our claimed bipolar plate assembly, which includes an electrically conductive contact element having an electrically conductive coating comprising a doped metal composition.

6. Gordon does not suggest to one skilled in the art that a doped metal oxide layer may be applied by his process to a metallic substrate consisting of, for example, aluminum, titanium, or stainless steel, and achieve low contact resistance between the layer and adjoining metallic substrate. Substrates consisting of stainless steel, aluminum, and titanium, unlike the glass substrates disclosed by Gordon, tend to oxidize in the presence of heat, such as that used by Gordon's process, causing a highly resistive oxide layer to form on the surface of the substrate.

7. Gordon discloses that the doped metal oxide layers formed by his process are useful for solar photovoltaic cells, photoconductive cells, liquid crystal electro-optical displays, photoelectrochemical cells, and other types of optical-electronic devices (Col. 1, lines 10-12). Importantly, electrochemical systems vary greatly. The environment of the solar cells disclosed by Gordon does not include the oxidizing and reducing gases (e.g., oxygen and hydrogen) and acidic compounds (e.g., per fluorocarbon sulfonic acid)

present in the fuel cell environment.

8. Un-doped tin oxide is unstable in the presence of the reducing gases (e.g., hydrogen) and the per fluorocarbon sulfonic acid present in the fuel cell environment and tends to form localized surface deposits of resistive tin oxide.

9. Li et al. discloses that layers of chromium, nickel, and molybdenum-rich stainless steels are useful as intermediate layers between a titanium nitride (TiN) topcoat layer and an aluminum or titanium substrate to inhibit corrosion of the substrate that may occur as a result of micro-discontinuities in the TiN topcoat layer. However, common oxides that form on compounds of stainless steel include hydrated iron oxide (i.e., rust) and chromium oxide, both of which exhibit high bulk and contact resistance. Li et al. discloses that the formation of dense oxide layers at the sites of the micro-discontinuities increases the fuel cell's internal resistance. Without detailed explanation, Li et al. maintains, however, that the fuel cell's internal resistance is not significantly increased. (Col. 3, lines 26-32). Implicit in this assertion is the limitation that the dense oxide layer forms only at the sites of the micro-discontinuities. Hydrated iron oxides and chromium oxide have contact resistance values of 300 and 500 milliohms-cm, respectively, and would significantly increase the resistance of the fuel if allowed to form more extensively within the conductive topcoat layer.

10. Oxygen and the per fluorocarbon sulfonic acid present in a fuel cell causes oxidation of exposed titanium nitride and the formation of a resistive titanium oxide surface layer.

11. Gyoten et al. discloses that the chromium oxides that form on a stainless steel sheet are electrically resistive, which supports the observations made in paragraph 9 above. (Col. 1, line 60 to Col. 2, line 2).

12. The conductive layer disclosed by Gyoten et al. illustrates the conventional wisdom and approach taken by skilled artisans where metallic oxides are present in the conductive elements of a fuel cell. While Gyoten et al. discloses a resin layer containing electroconductive particulate, such as ruthenium oxide (RuO_2), Gyoten et al. further discloses that the surface area of the particulate substance should be small to prevent increased contact resistance due to oxidation of the particulate. (Col. 4, lines 5-13). Thus, Gyoten et al. discloses a conductive layer that is resin rich at the exposed surface.

13. It is our experience, and we believe the experience of those skilled in the art of fuel cell design, that metal oxides, including tin oxide, generally do not possess the material properties required of the conductive elements of a fuel cell, including low electrical contact and bulk resistance.

14. Our efforts to develop a conductive element by applying a doped tin oxide layer to a bipolar plate assembly were contrary to the accepted wisdom and the prevailing approach in the field of fuel cell design at the time of our discovery. The conventional wisdom includes knowledge that un-doped tin oxide is unstable in the presence of the reducing gases (e.g., hydrogen) and the per fluorocarbon sulfonic acid present in the environment of the fuel cell and tends to form localized surface deposits of resistive tin oxide.

15. Absent from the teachings of Gordon are teachings of the unique anti-corrosion properties that can be achieved in tin oxide layers that have been doped with fluorine.

16. Passivating metals have been applied to metals susceptible to oxidation in the fuel cell environment (e.g., titanium or stainless steel) and metals that are susceptible to dissolution in the fuel cell environment (e.g., aluminum) to allow anti-corrosive metallic oxide layers to form, however these metallic oxide layers are known to be highly resistive. Topcoat layers, such as those disclosed by Li et al. and Gyoten et al., have been the conventional approach used to minimize the formation of such metallic oxide layers.

17. The technical problem we confronted includes providing a conductive layer on a metallic substrate capable of achieving and maintaining low contact resistance on a surface adjoining the substrate and an opposite surface exposed to the environment of the fuel cell and providing anti-corrosive properties that inhibit electrical degradation of the conductive layer.

18. During our experimentation with solutions to the above technical problem we began applying a doped metal oxide layer to the metallic substrates used in bipolar plates to see if a conductive layer exhibiting low contact resistance between adjoining surfaces could be achieved and to determine whether the layer and the interfaces between the layer and adjoining elements (e.g., substrate, PEM membrane) were susceptible to electrical degradation when exposed to the reactant gases and acidic compounds of the fuel cell. We experimented with temperatures at which the tin oxide layers were applied and the fluorine doping levels in an effort to achieve useful contact

resistance values. As a result of this experimentation, we learned that doping levels of between 0.5 and 1% (i.e., fluorine to oxygen ratios between .005 and .01) produced the lowest contact resistance and highest stability under the anodic and cathodic conditions of the fuel cell. We also learned that the surface of the substrate must be cleaned and polished to remove the presence of any metallic oxides before applying the doped tin oxide composition to the substrate. We learned that removal of the metallic oxides present on the surface of the substrate is important to achieving low contact resistance between the substrate and the doped tin oxide layer.

I, Gayatri (Vyas) Dadheech, hereby declare that the statements made herein of my own knowledge are true and that the statements made on information and belief are believed to be true. I declare further that these statements were made with the knowledge that willfully false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 the United States Code, and that any such willfully false statements may jeopardize the validity of the application and any patent issuing thereon, or any patent to which this declaration is directed.

Gaya

Gayatri (Vyas) Dadheech

February 21, 2008

Date

“EXHIBIT B”

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la·bil·i·ty \kō-ˌa-gyə-lə-'bi-lə-tē\ n — co·ag·u·la·ble \-'a-gyə-lə-bəl\ adj — co·ag·u·la·tion \-'lā-shən\ n

co·ag·u·lum \kō-'a-gyə-ləm\ n, pl -u·la \-lə\ or -ulums [L] (1658) : a coagulated mass or substance : CLOT

¹coal \'kōl\ n, often attrib [ME col, fr. OE; akin to OHG & ON kol burning ember, MIr gúal coal] (bef. 12c) 1 : a piece of glowing carbon or charred wood : EMBER 2 : CHARCOAL 1 3 a : a black or brownish-black solid combustible substance formed by the partial decomposition of vegetable matter without free access of air and under the influence of moisture and often increased pressure and temperature that is widely used as a natural fuel b pl, Brit : pieces or a quantity of the fuel broken up for burning

²coal vt (1602) 1 : to burn to charcoal : CHAR 2 : to supply with coal ~ vi : to take in coal

co·a·lesce \ˌkō-ə-'les\ vb co·a·lesced; co·a·lesc·ing [L coalescere, fr. co- + alescere to grow — more at OLD] vi (ca. 1656) 1 : to grow together 2 a : to unite into a whole : FUSE ⟨separate townships have coalesced into a single, sprawling colony —Donald Gould⟩ b : to unite for a common end : join forces ⟨people with different points of view ~ into opposing factions —I. L. Horowitz⟩ 3 : to arise from the combination of distinct elements ⟨an organized and a popular resistance immediately coalesced —C. C. Menges⟩ ~ vt : to cause to unite ⟨sometimes a book ~s a public into a mass market —Walter Meade⟩ syn see MIX — co·a·les·cence \-'le-sᵊn(t)s\ n — co·a·les·cent \-sᵊnt\ adj

coal·field \'kōl-ˌfēld\ n (1805) : a region rich in coal deposits

coal·fish \-ˌfish\ n (1603) : any of several blackish or dark-backed fishes (as a pollack, cobia, or sablefish)

coal gas n (1809) : gas made from coal: as a : the mixture of gases thrown off by burning coal b : gas made by carbonizing bituminous coal in retorts and used for heating and lighting

coal·hole \'kōl-ˌhōl\ n (ca. 1662) Brit : a compartment for storing coal

coal·i·fi·ca·tion \ˌkō-lə-fə-'kā-shən\ n (1911) : a process in which vegetable matter becomes converted into coal of increasingly higher rank with anthracite as the final product — coal·i·fy \'kō-lə-ˌfī\ vt

co·a·li·tion \ˌkō-ə-'li-shən\ n [F, fr. L coalescere] (1604) 1 a : the act of coalescing : UNION b : a body formed by the coalescing of orig. distinct elements : COMBINATION 2 : a temporary alliance of distinct parties, persons, or states for joint action — co·a·li·tion·ist \-'lish(ə-)nist\ n

coal measures n pl (1829) : beds of coal with the associated rocks

coal oil n (1851) 1 : petroleum or a refined oil prepared from it 2 : KEROSENE

coal seam n (1811) : a bed of coal usu. thick enough to be profitably mined

coal tar n (1785) : tar obtained by distillation of bituminous coal and used esp. as an industrial fuel, in making dyes, and in the topical treatment of skin disorders

coam·ing also comb·ing \'kō-miŋ\ n [prob. irreg. fr. comb] (1611) : a raised frame (as around a hatchway in the deck of a ship) to keep out water

co·apt \kō-'apt\ vt [LL coaptare, fr. L co- + aptus fastened, fit — more at APT] (1570) : to fit together and make fast — co·ap·ta·tion \(ˌ)kō-ˌap-'tā-shən\ n

co·arc·ta·tion \(ˌ)kō-ˌärk-'tā-shən\ n [L coarctation-, coarctatio tightening, fr. coarctare, coartare to constrict, fr. co- + artare to fix firmly, fr. artus close, tight; akin to L artus joint — more at ARTICLE] (1545) : a stricture or narrowing esp. of a canal or vessel (as the aorta)

coarse \'kōrs\ adj coars·er; coars·est [ME cors, perh. fr. course, n.] (14c) 1 : of ordinary or inferior quality or value : COMMON 2 a (1) : composed of relatively large parts or particles ⟨~ sand⟩ (2) : loose or rough in texture ⟨~ cloth⟩ b : adjusted or designed for heavy, fast, or less delicate work ⟨a ~ saw with large teeth⟩ c : not precise or detailed with respect to adjustment or discrimination 3 : crude or unrefined in taste, manners, or language 4 : harsh, raucous, or rough in tone 5 chiefly Brit : of or relating to coarse fish ⟨~ fishing⟩ — coarse·ly adv — coarse·ness n

syn COARSE, VULGAR, GROSS, OBSCENE, RIBALD mean offensive to good taste or morals. COARSE implies roughness, rudeness, or crudeness of spirit, behavior, or language ⟨found the coarse humor of coworkers offensive⟩. VULGAR often implies boorishness or ill-breeding ⟨a loud vulgar belch⟩. GROSS implies extreme coarseness and insensitiveness ⟨gross eating habits⟩. OBSCENE applies to anything strongly repulsive to the sense of decency and propriety esp. in sexual matters ⟨obscene language not allowed on the air⟩. RIBALD applies to what is amusingly or picturesquely vulgar or irreverent or mildly indecent ⟨entertained the campers with ribald folk songs⟩.

coarse fish n (1857) 1 : ROUGH FISH 2 chiefly Brit : a freshwater fish other than a salmonid

coarse–grained \'kōrs-ˌgrānd\ adj (ca. 1774) 1 : having a coarse grain ⟨~ wood⟩ 2 : CRUDE ⟨~ humor⟩

coars·en \'kōr-sᵊn\ vb coars·ened; coars·en·ing vt (1805) : to make coarse ~ vi : to become coarse

¹coast \'kōst\ n [ME cost, fr. AF coste, fr. L costa rib, side; akin to OCS kostĭ bone] (14c) 1 : the land near a shore : SEASHORE 2 obs : BORDER, FRONTIER 3 a : a hill or slope suited to coasting b : a slide down a slope (as on a sled) 4 often cap : the Pacific coast of the U.S. 5 : the immediate area of view — used in the phrase the coast is clear — coast·al \'kōs-tᵊl\ adj — coast·wise \'kōst-ˌwīz\ adv or adj — from coast to coast : across an entire nation or continent

²coast vt (14c) 1 obs : to move along or past the side of : SKIRT 2 : to sail along the shore of ~ vi 1 a archaic : to travel on land along a coast or along or past the side of something b : to sail along the shore 2 a : to slide, run, or glide downhill by the force of gravity b : to move along without or as if without further application of propulsive power (as by momentum or gravity) c : to proceed easily without special application of effort or concern ⟨~ed through school⟩ — often used with on ⟨a company ~ing on its good reputation⟩

coast·er \'kōs-tər\ n (1574) 1 : one that coasts: as a : a person engaged in coastal traffic or commerce b : a ship sailing along a coast or engaged in trade between ports of the same country 2 : a resident of a seacoast 3 a : a tray or decanter stand usu. of silver and sometimes on wheels b : a shallow container or a plate or mat to protect a surface 4 a : a small vehicle (as a sled or wagon) used in coasting b : ROLLER COASTER

coaster brake n (1899) : a brake in the hub of the rear wheel of a bicycle operated by reverse pressure on the pedals

coaster wagon n (1911) : a child's toy wagon often used for coasting

coast guard n (1833) 1 : a military or naval force employed in guarding a coast or responsible for the safety, order, and operation of maritime traffic in neighboring waters 2 usu coast·guard, chiefly Brit : COASTGUARDSMAN

coast·guards·man \'kōs(t)-ˌgärdz-mən\ or coast·guard·man \-ˌgärd-mən\ n (1848) : a member of a coast guard

coast·land \-ˌland\ n (1852) : land bordering the sea

coast·line \-ˌlīn\ n (1856) 1 : a line that forms the boundary between the land and the ocean or a lake 2 : the outline of a coast

coast redwood n (ca. 1897) : REDWOOD 3a

coast–to–coast \'kōs-tə-'kōst\ adj (1911) 1 : extending or airing across an entire nation or continent ⟨a ~ flight⟩ ⟨a ~ broadcast⟩ 2 : extending from one end of a playing surface (as a basketball court) to the other ⟨a ~ rush⟩; also : relating to or resulting from a coast-to-coast play ⟨a ~ layup⟩ — coast–to–coast adv

coast·ward \'kōst-wərd\ or coast·wards \-wərdz\ adv (1840) : toward the coast — coastward adj

¹coat \'kōt\ n, often attrib [ME cote, fr. AF, of Gmc origin; akin to OHG kozza coarse wool mantle] (14c) 1 a : an outer garment worn on the upper body and varying in length and style according to fashion and use b : something resembling a coat 2 : the external growth on an animal 3 : a layer of one substance covering another ⟨a ~ of paint⟩ — coat·ed \'kō-təd\ adj — coat·less adj

²coat vt (14c) 1 : to cover with a coat 2 : to cover or spread with a finishing, protecting, or enclosing layer — coat·er n

coat·dress \'kōt-ˌdres\ n (1854) : a dress styled like a coat usu. with a front buttoning from neckline to hemline

coat hanger n (1895) : a device which is shaped like the outline of a person's shoulders and over which garments may be hung

co·a·ti \kə-'wä-tē, kō-'ä-, kwä-'tē\ n [Pg quati, coati, fr. Tupi kwáti] (1676) : either of two tropical American mammals (Nasua nasua and N. narica) related to the raccoon but with a longer body and tail and a long flexible snout

co·a·ti·mun·di \kə-ˌwä-tē-'mən-dē, kō-ˌä-, ˌkwä-, -'mün-\ n [Pg quatimundé, fr. Tupi kwatimúnde, older male coati not with a band, fr. kwáti coati + múnde snare, trap] (1676) : COATI

coat·ing \'kō-tiŋ\ n (1768) 1 : cloth for coats 2 : COAT, COVERING

coat of arms [ME cote of armes, trans. of MF cote d'armes] (14c) 1 : a tabard or surcoat embroidered with armorial bearings 2 a : heraldic bearings (as of a person) usu. depicted on an escutcheon often with accompanying adjuncts (as a crest, motto, and supporters) b : a similar symbolic emblem

coat of mail (15c) : a garment of metal scales or chain mail worn as armor

coat·rack \'kōt-ˌrak\ n (1915) : a stand or rack fitted with pegs, hooks, or hangers and used for the temporary storage of garments

coat·room \-ˌrüm, -ˌrům\ n (1870) : CLOAKROOM, CHECKROOM

coat·tail \'kōt-ˌtāl\ n (ca. 1600) 1 : the rear flap of a man's coat 2 pl : the skirts of a dress coat, cutaway, or frock coat 3 pl : the influence or pulling power of a popular movement or person (as a political candidate) ⟨congressmen riding into office on the president's ~s⟩

¹coax \'kōks\ vt [earlier cokes, fr. cokes simpleton] (1581) 1 obs : FONDLE, PET 2 : to influence or gently urge by caressing or flattering : WHEEDLE ⟨~ed him into going⟩ 3 : to draw, gain, or persuade by means of gentle urging or flattery ⟨unable to ~ an answer out of him⟩ 4 : to manipulate with great perseverance and usu. with considerable effort toward a desired state or activity ⟨~ a fire to burn⟩ syn see CAJOLE

²co·ax \'kō-ˌaks\ n (1945) : COAXIAL CABLE

co·ax·i·al \(ˌ)kō-'ak-sē-əl\ adj (1881) 1 : having coincident axes 2 : mounted on concentric shafts — co·ax·i·al·ly \-sē-ə-lē\ adv

coaxial cable n (1936) : a transmission line that consists of a tube of electrically conducting material surrounding a central conductor held in place by insulators and that is used to transmit telegraph, telephone, and television signals — called also coax cable

cob \'käb\ n [ME cobbe leader of a group, head; prob. akin to cub (young animal), ME kebbe old cow or sheep, D dial. kabbe, kebbe piglet] (15c) 1 [perh. short for cobswan lead swan] : a male swan 2 a dial Eng : a rounded mass, lump, or heap b : a mixture of unburnt clay and straw used esp. for constructing walls of small houses in England 3 : a crudely struck old Spanish coin of irregular shape 4 : CORNCOB 1 5 : a stocky short-legged riding horse

co·bal·a·min \kō-'ba-lə-mən\ n [cobalt + vitamin] (1956) : VITAMIN B_{12}

co·balt \'kō-ˌbȯlt\ n [G Kobalt, alter. of Kobold, lit., goblin, fr. MHG kobolt; fr. its occurrence in silver ore, believed to be due to goblins] (1683) 1 : a tough lustrous silver-white magnetic metallic element that is related to and occurs with iron and nickel and is used esp. in alloys — see ELEMENT table 2 : COBALT BLUE 2

cobalt blue n (1835) 1 : a greenish-blue pigment consisting essentially of cobalt oxide and alumina 2 : a strong greenish blue

cobalt chloride n (1869) : a chloride of cobalt; esp : the dichloride $CoCl_2$ that is blue when dehydrated, turns red in the presence of moisture, and is used to indicate humidity

co·bal·tic \kō-'bȯl-tik\ adj (1782) : of, relating to, or containing cobalt esp. with a valence of three

co·balt·ite \'kō-ˌbȯl-ˌtīt, kō-'\ or co·balt·ine \-ˌtēn\ n [cobaltite, alter. of cobaltine, fr. F, fr. cobalt] (1868) : a grayish to silver-white mineral consisting of a sulfur arsenide of cobalt also containing iron and sometimes nickel and used in making smalt

co·bal·tous \kō-'bȯl-təs\ adj (1863) : of, relating to, or containing cobalt esp. with a valence of two

cobalt 60 n (1946) : a heavy radioactive isotope of cobalt of the mass number 60 produced in nuclear reactors and used as a source of gamma rays (as for radiotherapy)

²con·test \ˈkän-ˌtest\ n (1630) 1 : a struggle for superiority or victory : COMPETITION 2 : a competition in which each contestant performs without direct contact with or interference from his competitors

con·tes·tant \kən-ˈtes-tənt also ˈkän-ˌ\ n (1665) 1 : one that participates in a contest 2 : one that contests an award or decision

con·tes·ta·tion \ˌkän-ˌtes-ˈtā-shən\ n (1580) : CONTROVERSY, DEBATE

con·text \ˈkän-ˌtekst\ n [ME, weaving together of words, fr. L *contextus* connection of words, coherence, fr. *contexere* to weave together, fr. *com-* + *texere* to weave — more at TECHNICAL] (ca. 1568) 1 : the parts of a discourse that surround a word or passage and can throw light on its meaning 2 : the interrelated conditions in which something exists or occurs : ENVIRONMENT, SETTING ⟨the historical ~ of the war⟩ — con·text·less \-ˌtekst-ləs\ *adj* — con·tex·tu·al \kän-ˈteks-chə-wəl, kən-, -chəl, -chü-əl\ *adj* — con·tex·tu·al·ly *adv*

con·text–free \ˈkän-ˌtekst-ˈfrē\ *adj* (1964) : of, relating to, or being a grammar or language based on rules that describe a change in a string without reference to elements outside of the string; *also* : being such a rule

con·tex·tu·al·ize \kən-ˈteks-chə-wə-ˌlīz, -chə-ˌlīz, -chü-ə-\ *vt* -ized; -iz·ing (1934) : to place (as a word or activity) in a context — con·tex·tu·al·i·za·tion \-ˌteks-ch(ə-w)ə-lə-ˈzā-shən, -chü-ə-lə-\ *n*

con·tex·ture \kən-ˈteks-chər, ˈkän-ˌ, kän-ˈ\ *n* [F, fr. L *contextus*, pp. of *contexere*] (1603) 1 : the act, process, or manner of weaving parts into a whole; *also* : a structure so formed ⟨a ~ of lies⟩ 2 : CONTEXT

contg *abbr* containing

con·ti·gu·i·ty \ˌkän-tə-ˈgyü-ə-tē\ *n, pl* -ties (1612) : the quality or state of being contiguous : PROXIMITY

con·tig·u·ous \kən-ˈti-gyə-wəs, -gyü-əs\ *adj* [L *contiguus*, fr. *contingere* to have contact with — more at CONTINGENT] (ca. 1609) 1 : being in actual contact : touching along a boundary or at a point 2 *of angles* : ADJACENT 2 3 : next or near in time or sequence 4 : touching or connected throughout in an unbroken sequence ⟨~ row houses⟩ *syn* see ADJACENT — con·tig·u·ous·ly *adv* — con·tig·u·ous·ness *n*

con·ti·nence \ˈkän-tə-nən(t)s\ *n* (14c) 1 : SELF-RESTRAINT; *esp* : a refraining from sexual intercourse 2 : the ability to retain a bodily discharge voluntarily ⟨fecal ~⟩

¹con·ti·nent \ˈkän-tə-nənt\ *adj* [ME, fr. MF, fr. L *continent-, continens*, fr. prp. of *continēre* to hold in — more at CONTAIN] (14c) 1 : exercising continence 2 *obs* : RESTRICTIVE — con·ti·nent·ly *adv*

²con·ti·nent \ˈkän-tə-nənt, ˈkänt-nənt\ *n* [in senses 1 & 2, fr. L *continent-, continens*, prp. of *continēre*, to hold together, contain; in senses 3 & 4, fr. L *continent-, continens* continuous mass of land, mainland, fr. *continent-, continens*, prp.] (1541) 1 *archaic* : CONTAINER, CONFINES 2 *archaic* : EPITOME 3 : MAINLAND 4 a : one of the six or seven great divisions of land on the globe b *cap* : the continent of Europe — used with *the*

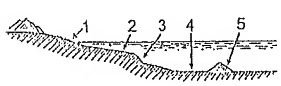
¹con·ti·nen·tal \ˌkän-tə-ˈnen-tᵊl\ *adj* (1758) 1 a : of, relating to, or characteristic of a continent ⟨~ waters⟩; *specif, often cap* : of or relating to the continent of Europe excluding the British Isles b *often cap* : of, relating to, or being a cuisine derived from the classic dishes of Europe and esp. France 2 a *often cap* : of or relating to the colonies later forming the U.S. ⟨*Continental* Congress⟩ b : being the part of the U.S. on the No. American continent; *also* : being the part of the U.S. comprising the lower 48 states — con·ti·nen·tal·ly \-tə-lē\ *adv*

²continental *n* (1777) 1 a *often cap* : an American soldier of the Revolution in the Continental army b (1) : a piece of Continental paper currency (2) : the least bit ⟨not worth a ~⟩ 2 : an inhabitant of a continent and esp. the continent of Europe

continental breakfast *n, often cap C* (1911) : a light breakfast (as of rolls or toast and coffee)

continental drift *n* (1926) : a slow movement of the continents on a deep-seated viscous zone within the earth — compare PLATE TECTONICS

continental shelf *n* (1892) : a shallow submarine plain of varying width forming a border to a continent and typically ending in a comparatively steep slope to the deep ocean floor



continental shelf: *1* seashore, *2* continental shelf, *3* continental slope, *4* abyssal plain, *5* seamount

continental slope *n* (1900) : the comparatively steep slope from a continental shelf to the ocean floor

con·tin·gence \kən-ˈtin-jən(t)s\ *n* (ca. 1530) 1 : CONTINGENCY 2 : TANGENCY

con·tin·gen·cy \kən-ˈtin-jən(t)-sē\ *n, pl* -cies (1561) 1 : the quality or state of being contingent 2 : a contingent event or condition: as a : an event (as an emergency) that may but is not certain to occur ⟨trying to provide for every ~⟩ b : something liable to happen as an adjunct to or result of something else *syn* see JUNCTURE

contingency fee *n* (1945) : a fee for services (as of a lawyer) paid upon successful completion of the services and usu. calculated as a percentage of the gain realized for the client — called also *contingent fee*

contingency table *n* (1904) : a table of data in which the row entries tabulate the data according to one variable and the column entries tabulate it according to another variable and which is used esp. in the study of the correlation between variables

¹con·tin·gent \kən-ˈtin-jənt\ *adj* [ME, fr. MF, fr. L *contingent-, contingens*, prp. of *contingere* to have contact with, befall, fr. *com-* + *tangere* to touch — more at TANGENT] (14c) 1 : likely but not certain to happen : POSSIBLE 2 : not logically necessary; *esp* : EMPIRICAL 3 a : happening by chance or unforeseen causes b : subject to chance or unseen effects : UNPREDICTABLE c : intended for use in circumstances not completely foreseen 4 : dependent on or conditioned by something else ⟨payment is ~ on fulfillment of certain conditions⟩ 5 : not necessitated : determined by free choice *syn* see ACCIDENTAL — con·tin·gent·ly *adv*

²contingent *n* (1548) 1 : something contingent : CONTINGENCY 2 : a representative group : DELEGATION, DETACHMENT ⟨a diplomatic ~⟩

con·tin·u·al \kən-ˈtin-yü-əl, -yəl\ *adj* [ME, fr. AF *continuel*, fr. L *continuus* continuous] (14c) 1 : continuing indefinitely in time without

syn CONTINUAL, CONTINUOUS, CONSTANT, INCESSANT,
PERENNIAL mean characterized by continued occurren
rence. CONTINUAL often implies a close prolonged succ
currence ⟨*continual* showers the whole weekend⟩. CONT
implies an uninterrupted flow or spatial extension ⟨foo
continuous rivalry⟩. CONSTANT implies uniform or pers
rence or recurrence ⟨lived in *constant* pain⟩. INCESS
ceaseless or uninterrupted activity ⟨annoyed by the *inces*
ing⟩. PERPETUAL suggests unfailing repetition or lasting
land of *perpetual* snowfall⟩. PERENNIAL implies enduring
ten through constant renewal ⟨a *perennial* source of cont

con·tin·u·ance \kən-ˈtin-yü-ən(t)s\ *n* (14c) 1 : CONTI
: the extent of continuing : DURATION 3 : the quality
: PERMANENCE 4 : an adjournment of a court case to a l

con·tin·u·ant \-yü-ənt\ *n* (1861) 1 : something that
serves as a continuation 2 : a speech sound (as a fricati
that is produced without a complete closure of the breat
compare STOP — continuant *adj*

con·tin·u·ate *adj* (1555) *obs* : CONTINUOUS, UNINTERRUP

con·tin·u·a·tion \kən-ˌtin-yə-ˈwā-shən, -yü-ˈā-\ *n* (14c) 1
fact of continuing in or the prolongation of a state or act
sumption after an interruption 3 : something that contin
es, or adds

con·tin·u·a·tive \kən-ˈtin-yə-ˌwā-tiv, -yü-ˌā-; -wə-tiv, -yü-
: expressing continuity or continuation (as of an idea or a

con·tin·u·a·tor \-ˌwā-tər\ *n* (1646) : one that continues

con·tin·ue \kən-ˈtin-(ˌ)yü\ *vb* -tin·ued; -tinu·ing [ME, fr.
er, fr. L *continuare*, fr. *continuus*] *vi* (14c) 1 : to maintai
terruption a condition, course, or action ⟨the boat *cont*
stream⟩ 2 : to remain in existence : ENDURE ⟨the tradi
: to remain in a place or condition : STAY ⟨cannot ~ he
ger⟩ 4 : to resume an activity after interruption ⟨we'll ~
~ *vt* 1 a : KEEP UP, MAINTAIN ⟨~s walking⟩ b : to k
add to : PROLONG ⟨~ the battle⟩; *also* : to resume after
2 : to cause to continue ⟨chose not to ~ her subscriptio
low to remain in a place or condition : RETAIN ⟨the trust
tinued⟩ 4 : to postpone (a legal proceeding) by a continu
tinu·er \-yü-ər\ *n*

syn CONTINUE, LAST, ENDURE, ABIDE, PERSIST mean t
period of time or indefinitely. CONTINUE applies to a pro
without ending ⟨the search for peace will *continue*⟩. LA
unqualified, may stress existing beyond what is normal
⟨buy shoes that will *last*⟩. ENDURE adds an implication o
structive forces or agencies ⟨in spite of everything, her fa
ABIDE implies stable and constant existing esp. as oppose
ity ⟨a love that *abides* through 40 years of marriage⟩. PEF
outlasting the normal or appointed time and often conno
or doggedness ⟨the sense of guilt *persisted*⟩.

continued *adj* (15c) 1 : lasting or extending without inte
success⟩ 2 : resumed after interruption ⟨a ~ story⟩

continued fraction *n* (1811) : a fraction whose numerato
and whose denominator is an integer plus a fraction who
is an integer and whose denominator is an integer plus a fr
on

continuing *adj* (14c) 1 : CONTINUOUS, CONSTANT ⟨~
: needing no renewal : ENDURING ⟨~ fame⟩ — con·tin·

continuing education *n* (1954) : formal courses of st
part-time students

con·ti·nu·i·ty \ˌkän-tə-ˈnü-ə-tē, -ˈnyü-\ *n, pl* -ties (15c)
rupted connection, succession, or union b : uninterru
or continuation esp. without essential change 2 : somet
exhibits, or provides continuity: as a : a script or scena
forming arts b : transitional spoken or musical matter e
or television program c : the story and dialogue of a c
: the property of being mathematically continuous

con·tin·uo \kən-ˈtin-yə-ˌwō, -ˈti-nə-\ *n, pl* -u·os [It, fr. *co*
uous, fr. L *continuus*] (ca. 1724) : a bass part (as for a
stringed instrument) used esp. in baroque ensemble musi
ing of a succession of bass notes with figures that indicat
chords — called also *figured bass, thoroughbass*

con·tin·u·ous \kən-ˈtin-yü-əs\ *adj* [L *continuus*, fr. *contin*
gether — more at CONTAIN] (1673) 1 : marked by unin
tension in space, time, or sequence 2 *of a function* : havi
ty that the absolute value of the numerical difference bet
ue at a given point and the value at any point in a neighb
given point can be made as close to zero as desired by
neighborhood small enough *syn* see CONTINUAL — co
ly *adv* — con·tin·u·ous·ness *n*

con·tin·u·um \kən-ˈtin-yü-əm\ *n, pl* -ua \-yü-ə\ *also* -u
of *continuus*] (1646) 1 : a coherent whole characterize
tion, sequence, or progression of values or elements vary
degrees ⟨"good" and "bad" . . . stand at opposite ends of a
describing the two halves of a line —Wayne Shumaker⟩
real numbers including both the rationals and the irrati
: a compact set which cannot be separated into two s
which contains a limit point of the other

con·tort \kən-ˈtȯrt\ *vb* [ME, fr. L *contortus*, pp. of *contorq*
+ *torquēre* to twist — more at TORTURE] *vt* (15c) : to twi
manner ⟨features ~*ed* with fury⟩ ~ *vi* : to twist into
strained shape or expression *syn* see DEFORM — con·t
shən\ *n* — con·tor·tive \-ˈtȯr-tiv\ *adj*

con·tor·tion·ist \kən-ˈtȯr-sh(ə-)nist\ *n* (1859) : one who c
: an acrobat able to twist the body into unusual posture
tion·is·tic \-ˌtȯr-shə-ˈnis-tik\ *adj*

¹con·tour \ˈkän-ˌtu̇r\ *n* [F, fr. It *contorno*, fr. *contornare* to
ML, to turn around, fr. L *com-* + *tornare* to turn on a lat
TURN] (1662) 1 : an outline esp. of a curving or ir
: SHAPE; *also* : the line representing this outline 2 : the
or structure of something : CHARACTERISTIC — often us
of a melody⟩ ⟨to delineate the tortured psychological ~

cous·in–ger·man \ˌkə-zən-ˈjər-mən\ *n, pl* **cous·ins–ger·man** \-zənz-\ [ME *cosin germain,* fr. MF, fr. OF, fr. *cosin* + *germain* german] (14c) : COUSIN 1a

Cousin Jack \ˌkə-zən-ˈjak\ *n* (1890) : CORNISHMAN; *esp* : a Cornish miner

[1]**couth** \ˈküth\ *adj* [back-formation fr. *uncouth*] (1896) : SOPHISTICATED, POLISHED

[2]**couth** *n* (1947) : POLISH, REFINEMENT ⟨I expected kindness and gentility . . . but there is such a thing as too much ~ —S. J. Perelman⟩

couth·ie \ˈkü-thē\ *adj* [ME *couth* familiar, fr. OE *cūth* — more at UNCOUTH] (1719) *chiefly Scot* : PLEASANT, KINDLY

cou·ture \kü-ˈtu̇r, -ˈtœr\ *n* [F, fr. OF *cousture* sewing, fr. VL **consutura,* fr. L *consutus,* pp. of *consuere* to sew together, fr. *com-* + *suere* to sew — more at SEW] (1908) **1** : the business of designing, making, and selling fashionable custom-made women's clothing **2** : the designers and establishments engaged in couture **3** : the clothes created by couture

cou·tu·ri·er \kü-ˈtu̇r-ē-ər, -ē-ˌā\ *n* [F, dressmaker, fr. OF *cousturier* tailor's assistant, fr. *cousture*] (1899) : an establishment engaged in couture; *also* : the proprietor of or designer for such an establishment

cou·tu·ri·ere \kü-ˈtu̇r-ē-ər, -ē-ˌer\ *n* [F *couturière,* fr. OF *cousturiere,* fem. of *cousturier*] (1818) : a woman who is a couturier

cou·vade \kü-ˈväd\ *n* [F, fr. MF, cowardly inactivity, fr. *cover* to sit on, brood over — more at COVEY] (1865) : a custom in some cultures in which when a child is born the father takes to bed as if bearing the child and submits himself to fasting, purification, or taboos

co·va·lence \ˌkō-ˈvā-lən(t)s, ˈkō-ˌ\ *n* (1919) : valence characterized by the sharing of electrons

co·va·len·cy \-lən(t)-sē\ *n* (1919) : COVALENCE

co·va·lent \ˌkō-ˈvā-lənt, ˈkō-ˌ\ *adj* (ca. 1926) : of, relating to, or characterized by covalent bonds — **co·va·lent·ly** \-lē\ *adv*

covalent bond *n* (1939) : a chemical bond formed between atoms by the sharing of electrons

co·vari·ance \ˌkō-ˈver-ē-ən(t)s, ˈkō-ˌ\ *n* (1931) **1** : the expected value of the product of the deviations of two random variables from their respective means **2** : the arithmetic mean of the products of the deviations of corresponding values of two quantitative variables from their respective means

co·vari·ant \-ənt\ *adj* [ISV] (1893) : varying with something else so as to preserve certain mathematical interrelations

co·vari·ate \-ˌāt, -ət\ *n* (1965) : any of two or more random variables exhibiting correlated variation

co·vari·a·tion \ˌkō-ˌver-ē-ˈā-shən\ *n* (1906) : correlated variation of two or more variables

co·vary \-ˈver-ē\ *vi* **-var·ied; -vary·ing** (1950) : to exhibit covariation

[1]**cove** \ˈkōv\ *n* [ME, den, fr. OE *cofa;* akin to OHG *chubisi* hut] (bef. 12c) **1** : a recessed place : CONCAVITY; as **a** : an architectural member with a concave cross section **b** : a trough for concealed lighting at the upper part of a wall **2** : a small sheltered inlet or bay **3 a** : a deep recess or small valley in the side of a mountain **b** : a level area sheltered by hills or mountains

[2]**cove** *vt* **coved; cov·ing** (1756) : to make in a hollow concave form

[3]**cove** *n* [Romany *kova* thing, person] (1567) *Brit* : MAN, FELLOW

co·vel·lite \kō-ˈve-ˌlīt, ˈkō-və-ˌ\ *also* **co·vel·line** \-ˌlēn\ *n* [F *covelline,* fr. Niccolò *Covelli* †1829 Ital. chemist] (1850) : a usu. blue mineral consisting of a sulfide of copper

co·ven \ˈkə-vən *also* ˈkō-\ *n* [ME *covin* agreement, confederacy, fr. AF *covine,* fr. ML *convenium* agreement, fr. L *convenire* to agree — more at CONVENIENT] (ca. 1520) **1** : a collection of individuals with similar interests or activities ⟨a ~ of intellectuals⟩ **2** : an assembly or band of usu. 13 witches

[1]**cov·e·nant** \ˈkəv-nənt, ˈkə-və-\ *n* [ME, fr. AF, fr. prp. of *covenir* to be fitting, fr. L *convenire*] (14c) **1** : a usu. formal, solemn, and binding agreement : COMPACT **2 a** : a written agreement or promise usu. under seal between two or more parties esp. for the performance of some action **b** : the common-law action to recover damages for breach of such a contract — **cov·e·nan·tal** \ˌkə-və-ˈnan-tᵊl\ *adj*

[2]**cov·e·nant** \-nənt, -ˌnant\ *vt* (14c) : to promise by a covenant : PLEDGE ~ *vi* : to enter into a covenant : CONTRACT

cov·e·nan·tee \ˌkə-və-ˌnan-ˈtē, -nən-\ *n* (1649) : the person to whom a promise in the form of a covenant is made

cov·e·nant·er \ˈkə-və-ˌnan-tər, *l also* ˌkə-və-ˈ\ *n* (1638) **1** *cap* : a signer or adherent of the Scottish National Covenant of 1638 **2** : one that makes a covenant

cov·e·nan·tor \ˈkə-və-ˌnan-tər; ˌkə-və-ˌnan-ˈtȯr, -nən-\ *n* (1649) : a party bound by a covenant

Cov·en·try \ˈkə-vən-trē *also* ˈkä-\ *n* [*Coventry,* England] (1765) : a state of ostracism or exclusion ⟨sent to ~⟩

[1]**cov·er** \ˈkə-vər\ *vb* **cov·ered; cov·er·ing** \ˈkəv-riŋ, ˈkə-və-\ [ME, fr. AF *coverir, covrir,* fr. L *cooperire,* fr. *co-* + *operire* to close, cover] *vt* (13c) **1 a** : to guard from attack **b (1)** : to have within the range of one's guns : COMMAND **(2)** : to hold within range of an aimed firearm **c (1)** : to afford protection or security to : INSURE **(2)** : to afford protection against or compensation for ⟨a policy ~*ing* loss by fire⟩ **d (1)** : to guard (an opponent) in order to obstruct a play ⟨a linebacker assigned to ~ the tight end⟩ **(2)** : to be in position to receive a throw to (a base in baseball) ⟨the shortstop was ~*ing* second⟩ **e (1)** : to make provision for (a demand or charge) by means of a reserve or deposit ⟨your balance is insufficient to ~ the check⟩ **(2)** : to maintain a check on esp. by patrolling **(3)** : to protect by contrivance or expedient **2 a** : to hide from sight or knowledge : CONCEAL ⟨~ up a scandal⟩ **b** : to lie over : ENVELOP ⟨a blanket ~*ing* her legs⟩ **3** : to lay or spread something over : OVERLAY ⟨~ the seed bed with straw⟩ **4 a** : to spread over ⟨snow ~*ed* the hills⟩ **b** : to appear here and there on the surface of ⟨a region ~*ed* with lakes⟩ **5** : to place or set a cover or covering over ⟨~ the pot⟩ **6 a** : to copulate with (a female animal) ⟨a horse ~*s* a mare⟩ **b** : to sit on and incubate (eggs) **7** : to invest with a large or excessive amount of something ⟨~*ed* herself with glory⟩ **8** : to play a higher-ranking card on (a previously played card) **9** : to have sufficient scope to include or take into account ⟨an examination ~*ing* a full year's work⟩ **10** : to deal with : TREAT ⟨material ~*ed* in the first chapter⟩ **11 a** : to have as one's territory or field of activity ⟨one sales rep ~*s* the whole state⟩ **b** : to report news about ⟨reporters ~*ing* the campaign⟩ **12** : to pass over : TRAVERSE ⟨the hikers ~*ed* 12 miles that day⟩ **13** : to defray the cost of ⟨~ expenses⟩ **14**

: to place one's stake in equal jeopardy with in a bet **15** :
rities or commodities for delivery against (an earlier sh
: to record or perform a cover of (a song) ~ *vi* **1** : to c
thing illicit, blameworthy, or embarrassing from notice
with *up* **2** : to act as a substitute or replacement during a
cov·er·able \ˈkəv-rə-bəl, ˈkə-və-\ *adj* — **co·ver·er** \ˈkə
cover one's tracks : to conceal traces in order to elud
escape detection — **cover the ground** *or* **cover grou**
with a subject or assignment in a particular manner ⟨the n
ers a lot of *ground*⟩

[2]**cover** *n, often attrib* (14c) **1** : something that protects
guards: as **a** : natural shelter for an animal; *also* : the fac
vide such shelter **b (1)** : a position or situation affordi
from enemy fire **(2)** : the protection offered by airplan
support of a military operation **c** *Brit* : COVERAGE 1a, b,
thing that is placed over or about another thing: **a** : LI
binding or case for a book or the analogous part of a m
: the front or back of such a binding **c** : an overlay or ou
for protection ⟨a mattress ~⟩ **d** : a tablecloth and the o
cessories **e** : COVER CHARGE **f** : ROOF **g** : a cloth used
warmth or for decoration — usu. used in pl. ⟨lying unde
: something (as vegetation or snow) that covers the groun
tent to which clouds obscure the sky **3 a** : something th
obscures ⟨under ~ of darkness⟩ **b** : a masking device :
project was a ~ for intelligence operations⟩ **4** : an enve
per for mail **5** : one who substitutes for another during a
: a recording or performance of a song previously record
performer — **cov·er·less** \ˈkə-vər-ləs\ *adj* — **under co**
envelope or wrapper **2** : under concealment : in secret

cov·er·age \ˈkəv-rij, ˈkə-və-\ *n* (1912) **1** : something that
: inclusion within the scope of an insurance policy or pr
: INSURANCE **b** : the amount available to meet liabiliti
sion within the scope of discussion or reporting ⟨the news
al⟩ **2** : the total group covered : SCOPE: as **a** : all the ris
the terms of an insurance contract **b** : the number or
persons reached by a communications medium **3** : the
covering

cov·er·all \ˈkə-vər-ˌȯl\ *n* (1824) : a one-piece outer garr
protect other garments — usu. used in pl. — **cov·er·alle**

cov·er–all \ˈkə-vər-ˌȯl\ *adj* (1895) : COMPREHENSIVE ⟨~

cover charge *n* (1921) : a charge made by a restaurant o
addition to the charge for food and drink

cover crop *n* (1899) : a crop planted to prevent soil erosi
vide humus

covered bridge *n* (1809) : a bridge that has its roadway p
roof and enclosing sides

covered smut *n* (1900) : a smut disease of grains in wh
masses are held together by the persistent grain membran

covered wagon *n* (1719) : a wagon with a canvas top
bowed strips of wood or metal

cover girl *n* (1915) : an attractive young woman whose p
on a magazine cover

cover glass *n* (1881) : a piece of very thin glass or plastic
material on a microscope slide

[1]**cov·er·ing** \ˈkəv-riŋ, ˈkə-və-\ *n* (14c) : something that c
ceals

[2]**covering** *adj* (1887) : containing explanation of or additi
tion about an accompanying communication ⟨a ~ letter

cov·er·let \ˈkə-vər-lət, -(ˌ)lid\ *n* [ME, alter. of *coverlite,* f
fr. *covre* (it) covers + *lit* bed, fr. L *lectus* — more at LIE
SPREAD

cov·er·slip \ˈkə-vər-ˌslip\ *n* (1875) : COVER GLASS

cover story *n* (1948) : a story accompanying a magazine-
tion

[1]**co·vert** \ˈkō-(ˌ)vərt, kō-ˈ; ˈkə-vərt\ *adj* [ME, fr. AF, pp. of
er] (14c) **1** : not openly shown, engaged in, or avowed :
alliance⟩ **2** : covered over : SHELTERED *syn* see SECRE
ly *adv* — **co·vert·ness** *n*

[2]**co·vert** \ˈkə-vərt, ˈkō-vərt *also* ˈkə-vər\ *n* (14c) **1 a** :
: SHELTER **b** : a thicket affording cover for game **c** :
concealing device **2** : a feather covering the bases of th
wings and tail of a bird — see WING illustration **3** : a
twilled sometimes waterproofed cloth usu. of mixed-colo

cov·er·ture \ˈkə-vər-ˌchu̇r, -chər, -ˌtyu̇r, -ˌtu̇r\ *n* (13c) **1**
b : SHELTER **2** : the status a woman acquires upon m
common law

cov·er–up \ˈkə-vər-ˌəp\ *n* (1927) **1 a** : a device or stratag
ing or concealing ⟨his garrulousness is a ~ for insecurit
concerted effort to keep an illegal or unethical act or s
being made public **2** : a loose outer garment

cov·et \ˈkə-vət\ *vb* [ME *coveiten,* fr. AF *coveiter,* fr. VL *c
L *cupiditat-, cupiditas* desire, fr. *cupidus* desirous, fr. *cupe*
(14c) **1** : to wish for earnestly ⟨~ an award⟩ **2** : to de
longs to another) inordinately or culpably ~ *vi* : to feel
sire for what belongs to another *syn* see DESIRE — **cov**
tə-bəl\ *adj* — **cov·et·er** \-tər\ *n* — **cov·et·ing·ly** \-tiŋ-lē

cov·et·ous \ˈkə-və-təs\ *adj* (13c) **1** : marked by inordi
wealth or possessions or for another's possessions **2** : ha
for possession ⟨~ of power⟩ — **cov·et·ous·ly** *adv* —
ness *n*

syn COVETOUS, GREEDY, ACQUISITIVE, GRASPING, AVA
having or showing a strong desire for esp. material pos
ETOUS implies inordinate desire often for another's poss
ous of his brother's country estate⟩. GREEDY stresses la
and often of discrimination in desire ⟨*greedy* for status
QUISITIVE implies both eagerness to possess and ability
keep ⟨an eagerly *acquisitive* mind⟩. GRASPING adds to C
GREEDY an implication of selfishness and often sugg
ruthless means ⟨a hard *grasping* trader who cheated the
RICIOUS implies obsessive acquisitiveness esp. of mone
suggests stinginess ⟨an *avaricious* miser⟩.

cov·ey \ˈkə-vē\ *n, pl* **coveys** [ME, fr. AF *covee* sitting (of
to sit on, brood over, fr. L *cubare* to lie] (14c) **1** : a matu